**Matrices**

**General :** in our study consider only two type of matrices :

1. **One dimensional matrices.**
2. **Two dimensional matrices.**
3. **One dimensional matrices :** consist of elements arranged in **one column** or **one array** each element has a constant position (location) in the matrix and this position remain constant until we change it.
* The matrix compound of name of matrix which recognized each matrix from the other and variables demonstrate the location (position) of each element :

Such as **A (5)** : matrix with name **A** and with **5** position .

* The matrix has a retain statement with general form :

No. of statement DIM name of matrix (constant)

Such as **10 DIM A (5)**

* The matrix must read before apply any application on its elements.

**Ex1 :** Write a program in basic language to print the first and last element of one dimensional matrix consist of 5 element [5 10 15 20 25].

**10 DIM A (5)**

20 FOR I = 1 TO 5

**30 READ A (I)**

40 DATA 5,10,15,20,25

50 NEXT I

Run

5 25

60 ? A(1) , A(5)

70 END

**Ex2 :** Write a program in basic language to print the element of one dimensional matrix consist of 5 element [5 10 15 20 25].

**10 DIM A (5)**

20 FOR I = 1 TO 5

**30 READ A (I)**

40 DATA 5,10,15,20,25

50 NEXT I

Run

5 10 15 20 25

60 FOR I = 1 TO 5

70 ? A(I)

80 NEXT I

90 END

**Ex3 :** Write a program in basic language to print the summation of the numbers [5 10 15 20 25].

**10 DIM A (5)**

20 FOR I = 1 TO 5

**30 READ A (I)**

40 DATA 5,10,15,20,25

50 NEXT I

Run

75

60 FOR I = 1 TO 5

70 S = S +A(I)

80 NEXT I

90 ? S

100 END

2

**Ex4 :** Write a program in basic language to find the maximum number from the following number (5 10 15 20 25).

**10 DIM A (5)**

20 FOR I = 1 TO 5

**30 READ A (I)**

40 DATA 5,10,15,20,25

50 NEXT I

60 MAX = A(1)

60 FOR I = 2 TO 5

80 IF A(I) > MAX THEN MAX = A(I)

90 NEXT I

120 ? MAX

130 END

**Ex5 :** Write a program in basic language to find the minimum number from the following number (5 10 15 20 25).

**10 DIM A (5)**

20 FOR I = 1 TO 5

**30 READ A (I)**

40 DATA 5,10,15,20,25

50 NEXT I

60

60 FOR I = 2 TO 5

80

90 NEXT I

120 ?

3

130 END

4

**Ex6 :** Write a program in basic language to arranged the following number from greatest to smallest (5 10 15 20 25).

**10 DIM A (5), B(5)**

20 FOR I = 1 TO 5

**30 READ A (I)**

40 DATA 5,10,15,20,25

**50 B(I) = ABS(A(I))**

60 NEXT I

70 FOR I = 1 TO 4

80 FOR J=1 TO 4

90 B(J+1) < B(J) THEN 110

**100 SWAP B(J+1) , B(J)**

110 NEXT J

120 NEXT I

130 FOR I = 1 TO 5

140 ? B(I)

150 NEXT I

160 END

**هذه الطرية افضل**

**10 DIM A (5), B(5)**

20 FOR I = 1 TO 5

**30 READ A (I)**

40 DATA 5,10,15,20,25

50 NEXT I

60 FOR I = 1 TO 4

70 FOR J=1 TO 4

80 A(J+1) < A(J) THEN 100

**90 SWAP A(J+1) , A(J)**

100 NEXT J

110 NEXT I

120 FOR I = 1 TO 5

130 ? A(I)

140 NEXT I

150 END

**W.H : Solve the exercises in the text book that related to one dimensional matrices.**

**Ex7 :** Solve Ex6 without use the **swap** statement ?

5

10 DIM A(5)

20 FOR I = 1 TO 5

30 READ A (I)

40 DATA 5,10,15,20,25

50 NEXT I

60 FOR I = 1 TO 4

70 FOR J = I+1 TO 4

90 IF A(J) > = A(I) THEN 130

**100 M = A(I)**

**110 A(I) = A(J)**

**120 A(J) = M**

130 NEXT J

140 NEXT I

150 FOR I =1 TO 5

160 PRINT A(I),

170 NEXT I

180 END

1. **Two dimensional matrices:** consists of elements arranged in columns and arrays. each element has a constant position (location) in the matrix and this position remain constant until we change it.

such as **A(10,10)** : matrix consists **100 elements** arranged in **10 arrays** and 10 columns.

For matrix A (n,n)

**Elements of major diagonal** : in this axis the value of **I = J** .

Such as a11: i=1, j=1 and a22 : i=2,j=2 ..

 a**11** a12 a13 a14

A = a21 a**22** a23 a24

 a31 a32 a**33** a34

 a41 a42 a43 a**44** 4x4

**Elements of minor diagonal** : in this axis the value of **I+J=n+1** .

Such as a14: I + J =5 =(n+1), n=4…..

 a11 a12 a13 a14

A = a21 a22 a23 a24

 a31 a32 a33 a34

 a41 a42 a43 a44 4x4

**Ex8:** write a program to read and print a matrix A(3x3).

10 DIM A (3,3)

 1 2 3

A = 4 5 6

 7 8 9

20 FOR I = 1 TO 3

30 FOR J = 1 TO 3

40 READ A(I,J)

50 DATA 1,2,3,4,5,6,7,8,9

60 NEXT J

5

70 NEXT I

80 FOR I = 1 TO 3

90 FOR J = 1 TO 3

6

100 PRINT A(I,J)

110 NEXT J

120 NEXT I

130 END

**Ex9 :** Read and print the same matrix array array?

**Ex10 :** For the above ex. Find the summation of the major diagonal elements.

10 DIM A (3,3)

 1 2 3

A = 4 5 6

 7 8 9

20 FOR I = 1 TO 3

30 FOR J = 1 TO 3

40 READ A(I,J)

50 DATA 1,2,3,4,5,6,7,8,9

60 NEXT J

70 NEXT I

80 FOR I = 1 TO 3

90 FOR J = 1 TO 3

100 IF I = J THEN S = S + A(I,J)

110 NEXT J

120 NEXT I

130 ? S

140 END

**Ex11 :** For the above ex. Find the summation of the minor diagonal elements.

7

10 DIM A (3,3)

 1 2 3

A = 4 5 6

 7 8 9

20 FOR I = 1 TO 3

30 FOR J = 1 TO 3

40 READ A(I,J)

50 DATA 1,2,3,4,5,6,7,8,9

60 NEXT J

70 NEXT I

80 FOR I = 1 TO 3

90 FOR J = 1 TO 3

100 IF I + J = 4 THEN S = S + A(I,J)

110 NEXT J

120 NEXT I

130 ? S

140 END

**Summation and subtraction of matrices :**

If we need to summation or subtraction any two matrices there is a condition must be provided before summation or subtraction this condition is the dimensions of the two matrices must be equal . such as A(3x3)+B(3x3)=C(3x3).

**Ex12:** write a program to find the summation of matrices A(N×M) and B(N×M) and store the result in new matrix C . then find the result of subtraction of the two matrices and store the result in new matrix D.

10 INPUT N,M

20 DIM A(N,M), B(N,M), C(N,M), D(N,M)

30 FOR I = 1 TO N

40 FOR J = 1 TO M

50 INPUT A(I,J), B(I,J)

8

60 NEXT J

70 NEXT I

80 FOR I = 1 TO N

90 FOR J = 1 TO M

100 C(I,J) = A(I,J) +B(I,J)

110 D(I,J) = A(I,J) - B(I,J)

120 NEXT J

130 NEXT I

140 FOR I = 1 TO N

150 FOR J = 1 TO M

160 ? C(I,J)

170 NEXT J : PRINT

180 NEXT I

190 FOR I = 1 TO N

200 FOR J = 1 TO M

210 ? D(I,J)

220 NEXT J : PRINT

230 NEXT I

240 END

**Ex13:** Write a program to read a two dimensional matrix compound of 4 arrays and 3 columns and then find the summation of all elements and print the matrix .

10 DIM A(4,3)

20 FOR I = 1 TO 4

30 FOR J = 1 TO 3

**40 INPUT A(I,J)**

50 NEXT J

60 NEXT I

70 FOR I = 1 TO 4

80 FOR J = 1 TO 3

90 S = S +A(I,J)

100 NEXT J

110 NEXT I

120 PRINT “ THE SUMMATION =”; S

130 FOR I = 1 TO 4

140 FOR J = 1 TO 3

150 PRINT A(I,J);

160 NEXT J

170 PRINT

180 NEXT I

190 END

* In the above program the matrix will print array –array. Repeat the above EX. But with print the matrix column-column.

9

**Ex14 :** Write a program to read a two dimensional matrix compound of 4 arrays and 3 columns and then convert the matrix to one dimensional matrix and then print the one dimensional matrix.

10 DIM A(4,3) , B(12)

20 FOR I = 1 TO 4

30 FOR J = 1 TO 3

**40 INPUT A(I,J)**

50 NEXT J

60 NEXT I

70 FOR I = 1 TO 4

80 FOR J = 1 TO 3

**90 K = K +1**

**100 B(K) = A(I,J)**

110 NEXT J

120 NEXT I

130 FOR L = 1 TO 12

140 PRINT B(L);

150 NEXT L

160 END

**Ex15 :** Write a program to read a one dimensional matrix compound of 12 elements and then convert the matrix to two dimensional matrix with 4 arrays and 3 columns and then print the two dimensional matrix.

10 DIM A(12) , B(4,3)

20 FOR I = 1 TO 12

**30 INPUT A(I)**

10

40 NEXT I

50 FOR J = 1 TO 4

11

60 FOR K = 1 TO 3

**70 M = M +1**

**80 B(J,K) = A(M)**

90 NEXT K

100 NEXT J

110 FOR I = 1 TO 4

120 FOR J = 1 TO 3

130 PRINT B(I,J);

140 NEXT J

150 PRINT

160 NEXT I

170 END

**Ex 16:** write a program to

1. Read the matrix A.
2. Summation the element of each array and then find the summation of all elements arrays.
3. Summation the element of each column and then find the summation of all elements columns.

10 INPUT M,N

20 FOR I = 1 TO M

30 FOR J = 1 TO N

40 READ A(I,J)

50 NEXT J

60 NEXT I

70 FOR I = 1 TO M

80 SR(I)=0

12

90 FOR J = 1 TO N

100 SR(I)=SR(I) + A(I,J)

110 NEXT J

115 PRINT SR(I),

120 S= S +SR(I)

130 NEXT I

140 PRINT “TOTAL SUMMATION OF ROW=”;S

150 PRINT

.

.

.

Complete for columns.

**Ex17** write a program to read the upper part for the matrix A(4x4) array array and then compound the lower part of the matrix if you knew that the matrix A is symmetry (A(I,J)=A(J,I)) and then print the full matrix.

10 DIM A(4,4)

20 FOR I = 1 TO 4

30 FOR J = 1 TO 4

40 READ A(I,J)

50 NEXT J

60 NEXT I

70 FOR I = 1 TO 4

80 FOR J = 1 TO 4

90 A(J,I)=A(I,J)

100 NEXT J

13

110 NEXT I

120 FOR I = 1 TO 4

130 FOR J = 1 TO 4

140 PRINT A(I,J)

150 NEXT J

160 PRINT

170 NEXT I

180 DATA 5,2,3,4,25,6,1,7,8

190 END

**Multiplication of the Matrices :**

When multiply two matrices A and B there is an condition must be satisfy (the number of column of matrix A must equal to the array of matrix B)

A(N,M) x B(M,K) = C(N,K)

such as A(3,3) x B(3,2) = C(3,2)

a11 a12 a13

a21 a22 a23

a31 a32 a33

b11 b12

b21 b22

b31 a32

A

B

C

c11 c12

c21 c22

c31 c32

x

=

3x3

3x2

3x2

 c11 = a11×b11+a12×b21+a13×b31

c12 = a11×b12+a12×b22+a13×b32

c21 = a21×b11+a22×b21+a23×b31

c22 = a21×b12+a22×b22+a23×b31

…………..

**Ex18:** write a program to find the result of multiply the matrix A (3,2) and matrix B(2,3) and store the result in matrix C

10 DIM A(3,2),B(2,3),C(3,3)

20 FOR I = 1 TO 3

30 FOR J = 1 TO 2

40 INPUT A(I,J)

50 NEXT J

60 NEXT I

70 FOR I = 1 TO 2

80 FOR J = 1 TO 3

90 INPUT B(I,J)

100 NEXT J : NEXT I

110 FOR I = 1 TO 3

120 FOR J = 1 TO 3

130 C(I,J)=0

140 FOR K = 1 TO 2

150 C(I,J) = C(I,J) + A(I,K)XB(K,J)

160 NEXT K : NEXT J : NEXT I

170 FOR I = 1 TO 3

180 FOR J = 1 TO 3

190 PRINT C(I,J);

200 NEXT J

240 PRINT

210 NEXT I

14

220 END

**Transpose of Matrix :**

15

The transpose of any matrix means make the arrays of the matrix columns and the columns arrays.

A (I,J) transpose B(J,I)

1 2 3

4 5 6

7 8 9

A

1 4 7

2 5 8

3 6 9

B

AT =

**Ex19 :** write a program to find the transpose of the matrix A .

10 DIM A(3,3),B(3,3)

1 2 3

4 5 6

7 8 9

A

20 FOR I = 1 TO 3

30 FOR J = 1 TO 3

40 READ A(I,J)

50 DATA 1,2,3,4,5,6,7,8,9

60 NEXT J : NEXT I

70 FOR I = 1 TO 3

1 4 7

2 5 8

3 6 9

B

AT =

80 FOR J = 1 TO 3

90 B(I,J)=A(J,I)

100 NEXT J : NEXT I

110 FOR I = 1 TO 3

120 FOR J = 1 TO 3

130 PRINT B(I,J)

140 NEXT J : NEXT I

150 END