الفصل الاول

المصفوفات

المصفوفات The Matrix

تعرف المصفوفة: حسب لغات البرمجة بأنها تجمع المعطيات من نفس النوع. ويمكن الرجوع إلى أي عنصر من هذا التجمع بواسطته (أي من خلال مؤشر نسميه المميز). تتدرج المصفوفات في Fortran 90 مابين احادية المميز (أحادية البعد), ومابين مصفوفات متعددة المميزات (متعددة الأبعاد).

1- المصفوفات ذات البعد الواحد One Dimension Array

مصفوفة فيها عدد من العناصر مرتبة بشكل أفقي أو عمودي.

جملة الأبعاد (Dimension): هو المتغير الذي يكون صفاً.

```
Real, Dimension (First: Last)::Name
Integer, Dimension (First: Last)::Name
Logical, Dimension (First: Last)::YesNo
Character (Len = No.), Dimension (First: Last)::char-list
```

Real, Dimension (1:9)::X, Y

Character(Len =8), Dimension(0:17)::Char-list

Example (1): ***Write program to read in the element values of array X(10), then print out the array in descending order?***

Solution:

```
Program descending
Implicit None
Integer:: I, J, K, L
Real, Dimension(1:10)::x
Real:: A
Do I = 1, 10
Print*,"Input x", (I)
```

```
Read*, x(I)
End Do
Do J =1, 9
Do K =J + 1, 10
If (x(J)< x(K)) then
A = x(J)
x(J) = x(K)
x(K) = A
End If
End Do
End Do
Do L = 1, 10
Print*, "x(L) =", x(L)
End Do
End program descending
```

Example (2): ***The following program reads in the 12 monthly values from the terminal, computes the sum and average for the year, and prints the average out?***

Solution:

```
Program Rainfall
Implicit None
Real, Dimension(1:12)::R
Real:: sun, average
Integer:: M
Do M =1, 12
Print*,"Input the rainfall values"
Read*, R(M)
End Do
Sum=0
Do M = 1, 12
sum = sum + R(M)
End Do
Average = sum/ 12
Print*, "Average monthly rainfall was", Average
```

End Program Rainfall

Two Dimension Array المصفوفات ذات البعدين

تعتبر مجموعة البيانات (Data) من (أرقام, رموز,...) المرتبة على شكل عدد من الصفوف (الأسطر) وعدد من الأعمدة بمثابة مصفوفة ذات بعدين.

1- Reading the matrix by Rows (Read Row by row)a) Do I = 1, 2

Do J = 1, 3

Read*, x(I, J)

End Do

End Do

b)Do I =1, 2

Read*, (x(I, J), J =1,3)

End Do

c)Read*, ((x(I, J), J=1, 3), I=1, 2)

**** Print the matrix (Row by Row)***

Do I =1, 2

Print*, (x(I, J), J=1, 3)

End Do

2- Reading the matrix by columns

(Read column by column)

a)Do J = 1, 3

Do I = 1, 2

Read*, x(I, J)

End Do

End Do

b)Do J=1, 3

Read*, (x(I, J), I=1,2)

End Do

c) Read*, ((x(I, J), I=1, 2), J=1, 3)

**** Print the matrix (column by column)***

Do J =1, 3

Print*, (x(I, J), I=1, 2)

End Do

Example (1): ***Write program to find the sum of matrix A(2, 3) and B(2, 3)to result the matrix C(2, 3)?***

$A=\begin{matrix}5 & 6 & 8\\ 3 & 52 & 4\end{matrix}$ $B=\begin{matrix}12 & 57 & 3\\ 5 & 6 & 9\end{matrix}$ ***Result the matrix*** $C=\begin{matrix}17 & 63 & 11\\ 8 & 58 & 13\end{matrix}$

Answer:

```
Program matrix
Implicit None
Integer, Dimension (1:2, 1:3)::A, B, C
Integer:: I, J
Print*, "Input the matrix A"
Read*, ((A(I, J), J=1, 3), I=1, 2)
Print*, "Input the matrix B"
Read*, ((B(I, J), J=1, 3), I=1, 2)
Do I=1, 2
Do J=1, 3
C(I, J) = A(I, J) + B(I, J)
End Do
End Do
Print*, "the matrix C is"
Do I = 1, 2
Print*, (C(I, J), J=1, 3)
End Do
End program matrix
```

Example(2): *Write program to find the magnitude of matrix multiplication A(2, 3) and B(3, 4)?*

$$A(2,3)\begin{vmatrix}2 & 1 & 3\\ 7 & 3 & 9\end{vmatrix} * B(3,4)\begin{Vmatrix}2 & 1 & 6 & 5\\ 4 & 8 & 6 & 2\\ 8 & 5 & 4 & 2\end{Vmatrix} = C(2,4)\begin{vmatrix}32 & 25 & 30 & 18\\ 98 & 76 & 96 & 59\end{vmatrix}$$

Solution:

```
Program matrix
Integer, Dimension (1:2, 1:3)::A
Integer, Dimension (1:3, 1:4)::B
Integer, Dimension (1:2, 1:4)::C
Integer::I, J, K
Print*, "Input the matrix A"
Read*, ((A (I, J), J=1, 3), I=1, 2)
Print*, "Input the matrix B"
Read*,((B(I, J), J=1, 4), I=1,3)
Print*, "the matrix C is"
Do I=1, 2
Do J=1, 4
C(I, J)=0
Do K = 1, 3
C(I, J) = C(I, J)+ A(I, K) * B(K, J)
End Do
End Do
End Do
Do  I=1, 2
Print*, (C(I, J), J=1, 4)
End Do
End program matrix
```

Example(3): *Write a program to integrate two array A and B in array C as following?* *A* *B* *C*

$$A=\begin{pmatrix} a1 \\ a2 \\ a3 \\ a4 \\ a5 \\ a6 \end{pmatrix} \quad B=\begin{pmatrix} b1 \\ b2 \\ b3 \\ b4 \\ b5 \\ b6 \end{pmatrix} \quad C=\begin{pmatrix} a1 \\ b1 \\ a2 \\ b2 \\ a3 \\ b3 \\ a4 \\ b4 \\ a5 \\ b5 \\ a6 \\ b6 \end{pmatrix}$$

Solution:

```
Program Q3
Implicit None
Real, Dimension(1:6)::A
Real, Dimension(1:6)::B
Real, Dimension(1:12)::C
Integer::I, J, K, L, M
Do I = 1, 6
Print*,"Input A"
Read*, A(I)
End Do
Do J = 1, 6
Print*,"Input B"
Read*, B(J)
End Do
L =0
Do K = 1, 12, 2
L =L+1
C(K) =A (L)
C(K+1) = B(L)
End Do
Do M =1, 12
Print*," C(M) =", C(M)
End Do
End Program Q3
```

Example (4): ***Write program to print student name and his average for six marks after reading the name for each students and his degrees to eight students?***

Solution:

```
Program Q4
Implicit None
Real, Dimension (1:6)::M
Character (Len=9), Dimension(1:8)::A$
Real, Dimension(1:8)::Average
Real::Sum
Integer::I, J
Do I =1, 8
Sum =0
Print*, "Input A$"
Read*, A$(I)
Do J=1, 6
Print*,"Input M"
Read*, M(J)
Sum = Sum + M(J)
End Do
Average(I) =Sum/6
Print*,"A$(I)=", A$(I)
Print*,"Average (I)=", Average (I)
End Do
End programQ4
```

Example (5): ***Write Program to find the array C , It's elements represent sum of each row of array B(3, 4)?***

$$B = \begin{matrix} 2 & 3 & 1 & 6 \\ 5 & 7 & 0 & 2 \\ 2 & 5 & 2 & 4 \end{matrix}$$

Solution:

```
Program Q5
Implicit None
Integer, Dimension (1:3, 1:4)::B
```

```
Integer, Dimension (1:3)::C
Integer: I, J, K
Print*, "Input the matrix B"
Read*, ((B(I, J), J =1, 4), I=1, 3)
Do I =1, 3
C(I)=0
Do J =1, 4
C(I) =C(I) + B(I, J)
End Do
End Do
Do K =1, 3
Print*, "C(K)=", C(K)
End Do
End Program Q5
```

Home Work

Q1: Write program to read in the element value of X(12), then add the value of D to become the 5th element in the new array X(13)?

Q2: Write program to input elements values of array A(6), then print the matrix B that represent inverse (inverted) values of array A?

Q3: Write program to read names of 50 students and 4 marks for each students, the program print name and average of less three students successful in average?

Q4: Write program to read elements of array A(N) their values are positive and negative, where the positive values in this array represent the matrix B and the negative values in array C, and then print the arrays B & C?

Q5: Write program to find fourth row for array B(3,4) their elements represent average of each column elements?

Q6: write program to make the array B their elements is large element value in each row and the array C their elements is smaller element value in each column form array A (4, 5)?