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7. ARRAY

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CHAPTER-7

Array

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Array

- Many applications require multiple data items that have common characteristics.
  - In mathematics, we often express such groups of data items in indexed form:
    - $x_1, x_2, x_3, \ldots, x_n$

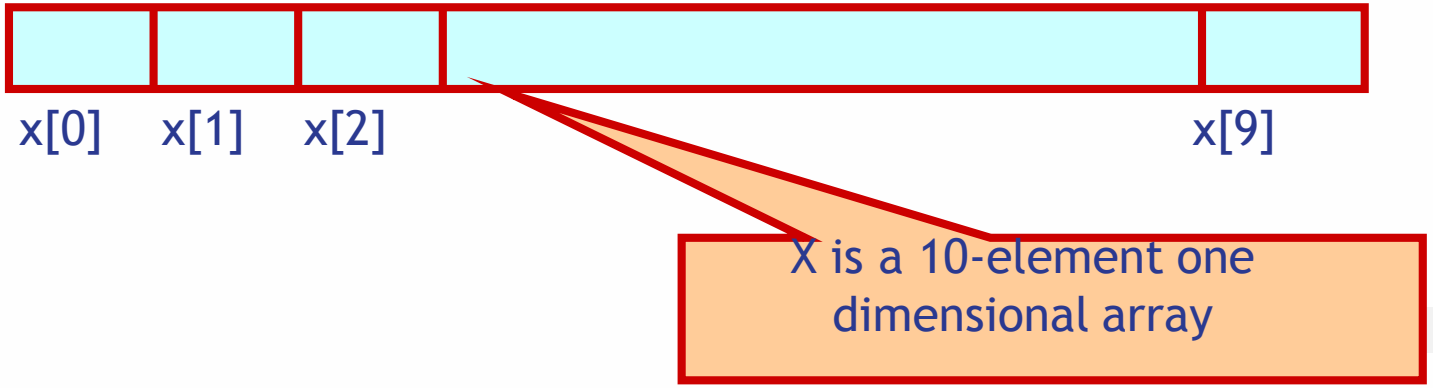
- Array is a data structure which can represent a collection of data items which have the same data type (float/int/char)

Array

- All the data items constituting the group share the same name.

```
int  x[10];
```

- Individual elements are accessed by specifying the index.



Declaring Arrays

Like variables, the arrays that are used in a program must be declared before they are used.

General syntax:--> type array-name [size];

- Type specifies the type of element that will be contained in the array (int, float, char, etc.)
- Size is an integer constant which indicates the maximum number of elements that can be stored inside the array.
- E.g. Marks is an array containing a maximum of 6 integers.

Declaring Arrays

- Examples:

```
int  x[10];

char  line[80];

float  points[150];

char  name[35];
```

- If we are not sure of the exact size of the array, we can define an array of a large size.

```
int   marks[50];
```

Accessing Array Elements

- A particular element of the array can be accessed by specifying two things:
  - Name of the array.
  - Index (relative position) of the element in the array.
- In C, the index of an array starts from zero.
  - Example:
    - An array is defined as int x[10];
    - The first element of the array x can be

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Initialization of Arrays

- General form:
  - type array_name[size] = { list of values };
- Examples:
  - int marks[5] = {72, 83, 65, 80, 76};
  - char name[4] = {'A', 'm', 'i', 't'};
- Some special cases:
  - If the number of values in the list is less than the number of elements, the remaining elements are automatically set to zero.
  - float total[5] = {24.2, -12.5, 35.1};
    - total[0]=24.2, total[1]=-12.5, total[2]=35.1, total[3]=0.0, total[4]=0.0

Initialization of Arrays(Cont..)

- The size may be omitted. In such cases the compiler automatically allocates enough space for all initialized elements.
  - int flag[] = {1, 1, 1, 0};
  - char name[] = {‘A’, ‘m’, ‘i’, ‘t’};

Character Arrays and Strings

- char C[8] = { 'a', 'b', 'h', 'i', 'j', 'i', 't', '\0' };
  - C[0] gets the value 'a', C[1] the value 'b', and so on. The last (7th) location receives the null character '\0'.
- Null-terminated character arrays are also called strings.
- Strings can be initialized in an alternative way. The last declaration is equivalent to:
  - char C[8] = "Abhijit";
- The trailing null character is missing here. C automatically puts it at the end.
- Note also that for individual characters, C uses single quotes, whereas for strings, it uses double quotes.

Example: Find the minimum of a set of 10 numbers

```
#include  <stdio.h>
void main()
{
    int  a[10], i, min;

    for  (i=0; i<10; i++)
        scanf ("%d", &a[i]);

    min = 99999;
    for  (i=0; i<10; i++)
    {
        if  (a[i] < min)
            min = a[i];
    }
    printf ("\n Minimum is %d", min);
}
```

How to read the elements of an array?

By reading them one element at a time

```
for  (j=0; j<25;
j++)
scanf  (“%f”,
&a[j]);
```

The ampersand (&) is necessary.

The elements can be entered all in one line or in different lines.

How to print the elements of an array?

- By printing them one element at a time.

```
for  (j=0; j<25; j++)
    printf  ("\n %f", a[j]);
```

  - The elements are printed one per line.

```
printf  ("\n");
for  (j=0; j<25; j++)
    printf (" %f", a[j]);
```

  - The elements are printed all in one line (starting with a new line).

Two Dimensional Arrays

- We have seen that an array variable can store a list of values.
- Many applications require us to store a table of values.

	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
Student 1	75	82	90	65	76
Student 2	68	75	80	70	72
Student 3	88	74	85	76	80
Student 4	50	65	68	40	70

Contd.

- The table contains a total of 20 values, five in each line.
  - The table can be regarded as a matrix consisting of four rows and five columns.

- C allows us to define such tables of items by using two-dimensional arrays.

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Declaring 2-D Arrays

- General form:

  type array_name [row_size][column_size];

- Examples:

  int marks[4][5];

  float sales[12][25];

  double matrix[100][100];

Accessing Elements of a 2-D Array

- Similar to that for 1-D array, but use two indices.
  - First indicates row, second indicates column.
  - Both the indices should be expressions which evaluate to integer values.
- Examples:

```
x[m][n] = 0;

c[i][k] += a[i][j] * b[j][k];

a = sqrt (a[j*3][k]);
```

How to read the elements of a 2-D array?

- By reading them one element at a time

```
for  (i=0; i<nrow; i++)
    for  (j=0; j<ncol; j++)
        scanf  (“%f”, &a[i][j]);
```

- The ampersand (&) is necessary.
- The elements can be entered all in one line or in different lines.

How to print the elements of a 2-D array?

- By printing them one element at a time.

```
for  (i=0; i<nrow; i++)
    for  (j=0; j<ncol; j++)
        printf  ("\n %f", a[i][j]);
```

  - The elements are printed one per line.

```
for  (i=0; i<nrow; i++)
    for  (j=0; j<ncol; j++)
        printf  ("%f", a[i][j]);
```

  - The elements are all printed on the same line.

Contd.

```
for  (i=0; i<nrow; i++)
{
    printf  ("\n");
    for  (j=0; j<ncol; j++)
        printf ("%f   ", a[i][j]);
 }
```

- The elements are printed nicely in matrix form.

Multi-Dimensional Arrays

- Syntax: type array_name[s1][s2]……[sm];
- Eg: int survey[3][5][12][11];
- Survey is a four dimensional array
- ANSI C does not specify any limit for array dimension. However, most of the compilers permit seven to ten dimensions. Some allow even more.

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