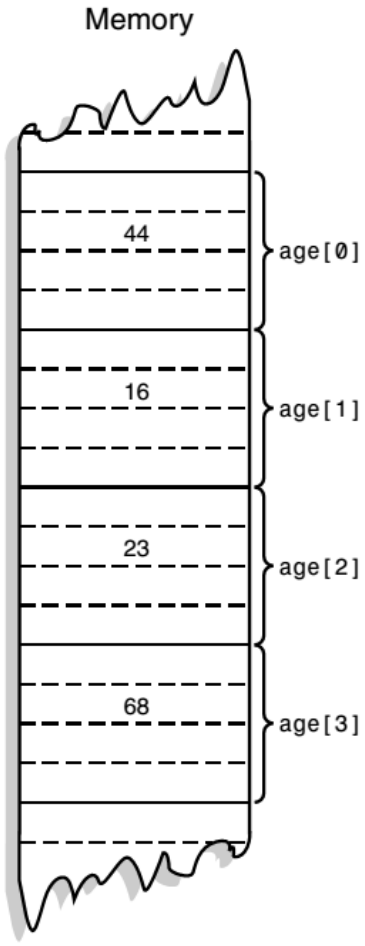
Computer Programming

Lab Manual No 05

Arrays in C++



Semester:

Spring 2016

Objectives:-

The objectives of this session is to learn working and advantages of array in C++.

ARRAYS:-

An array is a sequence of objects of same data type. The objects in an array are also called elements of array.

An array is represented in the computer memory by a consecutive group of storage locations. These locations are referenced by a single variable called array name. Each element of an array is referenced by its position in an array.

The position of an element in an array is represented by an index value or subscript. In an array with "n" elements, the index values are 0,1,2,-----,n-1, where '0' represents the index value of first element and 'n-1' represents the index value of the last element.

An element of an array is accessed by its subscript value. The subscript or index value is written inside a pair of square brackets [ ] with the name of array. An element of an array is referenced by specifying name of the array and the index value of the element.

Arrays are used to process a large amount of data of same type. The data is stored in an array. The array is accessed by a single variable name. The index values are used to access individual elements of an array. A few statements are required to process data in an array. Therefore, the use of arrays in a program reduces size of the program.

Arrays are divided into two types. These are:

i. One-Dimensional Arrays.
ii. Multi-Dimensional Arrays.

One Dimensional Array:-

One dimensional array is also known as list or a linear array. It consists of only one column and one row.

For example, the temperature of each hour of a day is stored in an array. The name of the array is "temp" and its elements are temp[0],temp[1],temp[2],temp[3],temp[4],temp[5]……. ,temp[23].

temp

temp[0]	**22.2**
temp[1]	**23.5**
temp[2]	**19.7**
temp[3]	
temp[4]	
temp[5]	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
.	
temp[23]	**15.3**

The above array "temp" contain real type data. It has 24 elements. The first element of the array is temp[0] that is in position 0 and temp[1] is the second element of array and is in position 1. Similarly, 24th element is the last element and it reference is temp[23].

Declaring One Dimensional Arrays:-

Like other variables, an array is also declared. Defining the name of array, its type and the total number of element of an array is called declaring of an array. When an array is declared a memory block with required number of location is reserved in the computer memory for storing data into elements of an array.

The general syntax to declare a one dimensional array is:

```
type array-name[n];
```

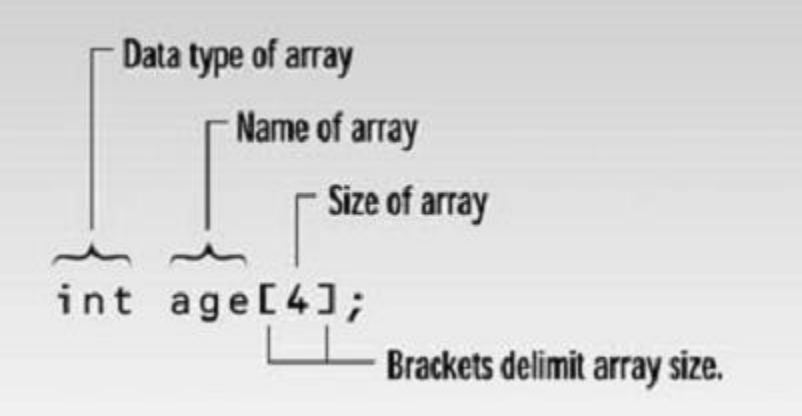
where "n" is an unsigned integer value. It represents the total number of elements of an array.

To declare a one dimensional array "temp" of type double with 24 elements, the statement is written as:

```
double temp[24];
```

Similarly to declare a one dimensional array with array name "abc" having five elements and of integer type, the statement is written as:

```
int abc[5];
```



Accessing Data in one Dimensional Array:-

Each element of an array is referenced by its index. In an array of n elements, each element has an index value. The index of the first element is 0 and of the last element is n-1.

The index value is written within square brackets after the array name.

Thus the first element of an array is referenced as temp[0]. Similarly the last element of an array is referenced as temp[n-1].

Input/ Output Data in One Dimensional Arrays:-

Data is entered in an array using the input statements like "cin" or "assignment" statements. It is entered into individual elements of an array. Separate input statement is used to enter data into each element of an array.

Similarly to print the data from an array, the output statement are used. The data from each individual element of an array is accessed.

Since similar input/output statement is used to access data in each element of the array, the statement is written once and a loop structure is used to repeat the input/output statement to access data of the elements of the array.

In the following program, an assignment statement has been used to input data into elements of an array. The "cout" output statement has been used to print data of the elements of an array on the screen. The loop structure repeats the output statement for each individual element of the array by changing index values.

Example 1:-

Write a program to declare an array of 5 elements and assign the values to the array and then print the values on the screen.

```
#include<iostream>

#include<cstdlib>

using namespace std;

int main()

{

    float a[5];

    int i;

    a[0]=9.9;

    a[1]=12.9;

    a[2]=13.1;

    a[3]=8.9;

    a[4]=10.6;

    for(i=0; i<=4;i++)
```

```
    cout<<"Value in a["<<i<<"]= "<<a[i]<<endl;
    system("pause");
    return 0;
}
```

Example 2:-

Write a program in C++ to enter integer type data into an array and then to print the values in reverse order.

```
#include<iostream>
#include<cstdlib>
using namespace std;
int main()
{
    int abc[5],i;
    for(i=0;i<=4;i++)
    {
           cout<<"Enter element no "<<i+1<<" of the array \n";
                    cin>>abc[i];
    }
    cout<<"The values in reverse order are: \n\n";
    for(i=4;i>=0;i--)
    {
          cout<<"Value at location "<<i+1<<" is "<<abc[i]<<endl;
    }
```

```
    system("pause");

    return 0;

}
```

Lab Task:-

1. Write a program in C++ to input data into an array of 5 elements. Calculate the sum and average of the elements and then print the sum and average on the screen.
2. Write a program in C++ to find out and print the maximum value in an array.
3. Write a program to input data into two different arrays and then add two arrays and store the result in the third array.
4. Write a program in C++ to input data into an array. Enter a value from the keyboard and find out the location of the entered value in an array. If the entered number is not found in the array, display the message "Number not found". Also ask the user whether he wants to use the program again or not.

Initializing One- Dimensional Arrays:-

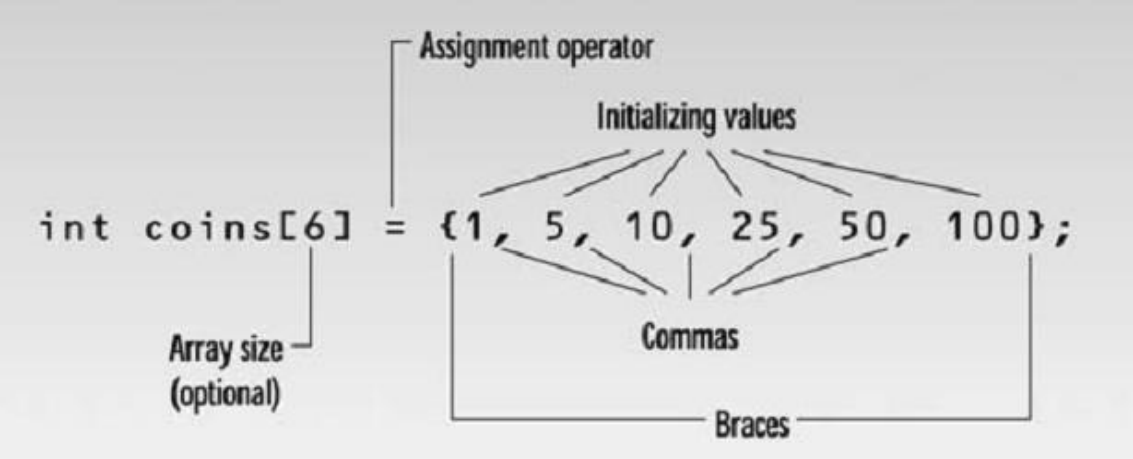
Like other variables, the values in the elements of an array can be assigned when the array is declared. The assigning of values to the elements of an array at the time of declaration is called initializing of array.

For example, to declare an array "temp" of type double with 5 elements with values 66.3,77.7,99.2,63.9 and 59.3 in elements temp[0], temp[1], temp[2], temp[3], temp[4] respectively, the statement is written as:

```
double temp[5]={ 66.3, 77.7, 99.2, 63.9, 59.3 };
```

The values on right hand side enclosed in curly braces are assigned to the elements of an array in the order in which they are written.

If the number of elements in an array is greater than the values in the list then the remaining last elements are initialized to zero.



Example 3:-

Write a program to initialize the values in array and then print these values on the screen.

```
#include<iostream>
#include<cstdlib>
using namespace std;
int main()
{
    double temp[5]={ 66.3, 77.7, 99.2, 63.9, 59.3 };
    int i;
    for(i=0;i<=4;i++)
    {
                    cout<<temp[i]<<endl;
    }
    system("pause");
```

```
    return 0;
}
```

The values can also be assigned to the elements of an array using assignment statements. When assignment statements are used, a separate assignment statement is required for each element of an array.

Using the assignment statements, the above program is written as:

```
#include<iostream>
#include<cstdlib>
using namespace std;
int main()
{
    double temp[5];
    int i;
    temp[0]=66.2;
    temp[1]=63.2;
    temp[2]=69.6;
    temp[3]=70.2;
    temp[4]=55.4;
    for(i=0; i<=4;i++)
    cout<<temp[i]<<endl;
    system("pause");
    return 0;
}
```

The values in an array of character type can also be initialized in the similar way but the characters are written in single quotes.

```
char abc[8] = {'P','A','K','I','S','T','A','N'};
```

Each element occupies one byte of memory, thus in each element of array only one character can be stored.

Lab Task:-

Write a program in C++ to initialize values in a character type array by saving your name in the array, copy these values into second array of the same type and then print the values from the second array on the screen.

Home Assignment:-

1. **Write a program in C++ to input 20 values into an array. Find out the total number of odd and even values entered in the array.**
2. **Write a program that allows the user to enter the number of votes received by 5 candidate. The program should then output candidate's number, the number of votes received, and the percentage of the total votes received by the candidate. A sample output is:**

Candidate	Votes Received	% of Total Votes
1	5000	25.91

3. **A company pays its sales people on a commission basis. The sales people each receive $200 per week plus 9 percent of their gross sales for that week. For example, a sales person who grosses $5000 in sales in a week receives $200 plus 9 percent of $5000, or a total of $650. Write a program (using an array of counters) that determines how many of the sales people earned salaries in each of the following ranges.**

a) $200-299
b) $300-399
c) $400-499
d) $500-599
e) $600-699
f) $700-799
g) $800-899
h) $900-999
i) $1000 and over.

Write the program or 20 sales persons.

4. A small airline has just purchased a computer for its new automated reservations system. You've been asked to program the new system. You are to write a program to assign seats on each flight of the airline's only plane (capacity: 10 seats).
Your program should display the following menu of alternatives—Please type 1 for "First Class" and Please type 2 for "Economy". If the person types 1, your program should assign a seat in the first class section (seats 1-5).If the person types 2, your program should assign a seat in the economy section (seats 6-10). Your program should print a boarding pass indicating the person's seat number and whether it's in the first class or economy section of the plane.
Your program should, of course, never assign a seat that has already been assigned. When the first class section is full, your program should ask the person if it's acceptable to be placed in the economy section (and vice versa).If yes, then make the appropriate seat assignment. If no, then print the message "Next flight leaves in 3 hours."