National University of Computer and Emerging Sciences

Lab Manual # 8

Programming Fundamentals

(Section BCS-A)

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Objectives

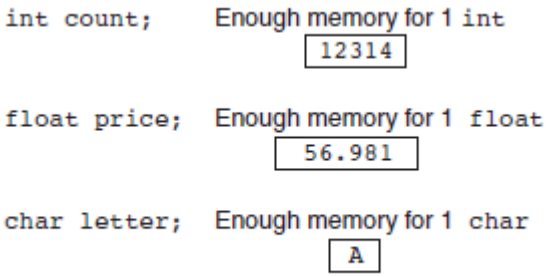
The objectives of this lab are to cover the following:

- To learn what is array
- Accessing Array Elements
- Array Initialization
- Nested Loop

Array:

An array allows you to store and work with multiple values of the same data type.

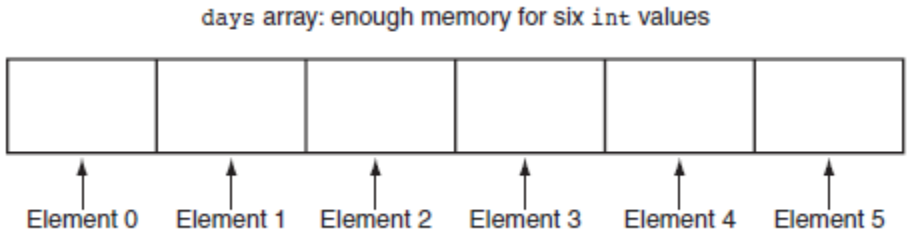
The variables you have worked with so far are designed to hold only one value at a time. Each of the variable definitions in causes only enough memory to be reserved to hold one value of the specified data type.



An array works like a variable that can store a group of values, all of the same type. The values are stored together in consecutive memory locations. Here is a definition of an array of integers:

int **days**[6];

The name of this array is days. The number inside the brackets is the array's size declarator. It indicates the number of elements, or values, the array can hold. The day's array can store six elements, each one an integer.



An array's size declarator must be a constant integer expression with a value greater than zero. It can be either a literal, as in the previous example, or a named constant, as shown in the following:

```
const int NUM_DAYS = 6;

int days[NUM_DAYS];
```

Arrays of any data type can be defined. The following are all valid array definitions:

```
float temperatures[100];        // Array of 100 floats

string names[10];               // Array of 10 string objects

long units[50];                 // Array of 50 long integers

double sizes[1200];             // Array of 1200 doubles
```

Memory Requirements of Arrays

Array Definition	Number of Elements	Size of Each Element	Size of the Array
`char letters[25];`	25	1 byte	25 bytes
`short rings[100];`	100	2 bytes	200 bytes
`int miles[84];`	84	4 bytes	336 bytes
`float temp[12];`	12	4 bytes	48 bytes
`double distance[1000];`	1000	8 bytes	8000 bytes

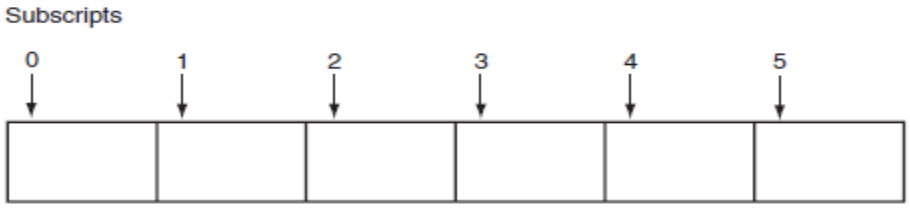
Accessing Array Elements

The individual elements of an array are assigned unique subscripts.
These subscripts are used to access the elements.

Consider array

int hours[6] ;

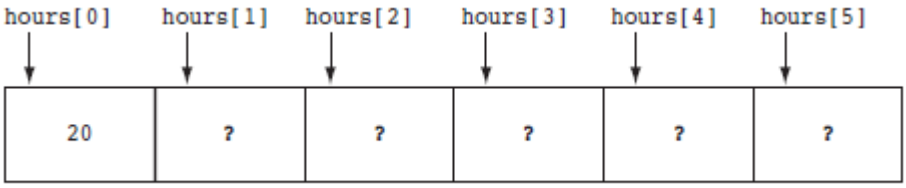
Even though an entire array has only one name, the elements may be accessed and used as individual variables. This is possible because each element is assigned a number known as a **subscript**. A subscript is used as an index to pinpoint a specific element within an array. The first element is assigned the subscript 0, the second element is assigned 1, and so forth. The six elements in the array hours would have the subscripts 0 through 5.



Each element in the hours array, when accessed by its subscript, can be used as a short variable. Here is an example of a statement that stores the number 20 in the first element of the array:

hours[0] = 20;

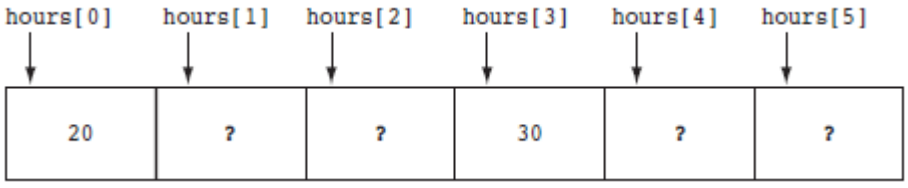
The contents of the array hours after the statement assigns 20 to hours[0] .



The following statement stores the integer 30 in hours[3] .

hours[3] = 30;

The contents of the array after the previous statement executes:



Inputting and Outputting Array Contents

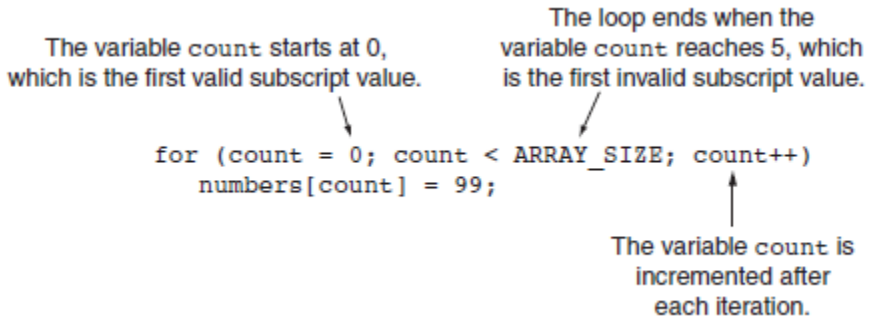
Array elements may be used with the cin and cout objects like any other variable. Program shows the array hours being used to store and display values entered by the user.

```
const int ARRAY_SIZE = 5;

int numbers[ARRAY_SIZE];


for (int count = 0; count < ARRAY_SIZE; count++)
numbers[count] = 99;
```

This code first defines a constant int named ARRAY_SIZE and initializes it with the value 5. Then it defines an int array named numbers, using ARRAY_SIZE as the size declarator. As a result, the numbers array will have five elements. The for loop uses a counter variable named count. This loop will iterate five times, and during the loop iterations the count variable will take on the values 0 through 4.



Sample Program

```
#include <iostream>
using namespace std;
int main()
{
 const int NUM_EMPLOYEES = 6;         // Number of employees
 int hours[NUM_EMPLOYEES];           // Each employee's hours
 int count;                                    // Loop counter

// Input the hours worked.
 for (count = 0; count < NUM_EMPLOYEES; count++)
{
cout << “Enter the hours worked by employee ” << (count + 1) << ": ";
cin >> hours[count];
}

 // Display the contents of the array.
 cout << "The hours you entered are:";
for (count = 0; count < NUM_EMPLOYEES; count++)
cout << " " << hours[count];
cout << endl;
 return 0;
 }
```

Output

Enter the hours worked by employee 1: **20 [Enter]**

Enter the hours worked by employee 2: **12 [Enter]**

Enter the hours worked by employee 3: **40 [Enter]**

Enter the hours worked by employee 4: **30 [Enter]**

Enter the hours worked by employee 5: **30 [Enter]**

Enter the hours worked by employee 6: **15 [Enter]**

The hours you entered are: 20 12 40 30 30 15

Problems

Question#1

Write a program that lets the user enter 10 values into an array. The program should then display the largest and smallest values stored in the array.

Question#2

Write a program that lets the user enter the total rainfall for each of 12 months into an array of doubles. The program should calculate and display the total rainfall for the year, the average monthly rainfall, and the months with the highest and lowest amounts.

Input Validation: *Do not accept negative numbers for monthly rainfall figures.*

Question#3

Write a program that lets user enter **N** values in the array and then display all numbers of the array that are greater than number **M**.

Question#4

Write a program that will ask from user about shapetype ,Square or Triangle and Size of the shapetype.

Consider **S** for Square and **T** for triangle and draw the shape according to user requirements.

('S', 4); a square of size 4 is displayed as follows

1 2 3 4

1 2 3 4

1 2 3 4

1 2 3 4

('T', 4); a triangle of size 4 is displayed as follows

1

1 2

1 2 3

1 2 3 4

1 2 3

1 2

1

END