

*Lesson 1 from*

**STRUCTURED PROGRAMMING**

*First Class*

## Computer Science Department

### Arrays:

An array is a variable that can store multiple values of the same type. Suppose a class has 27 students, and we need to store the grades of all of them. Instead of creating 27 separate variables, we can simply create an array.

An array is a consecutive group of homogeneous memory locations. Each element (location) can be referred to using the array name along with an integer that denotes the relative index of that element within the array. The data items grouped in an array can be simple types like int or float; or can be user-defined types like structures and objects.

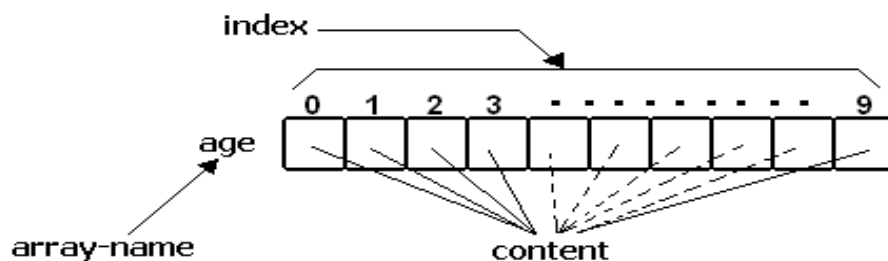
### 1. Array of one dimension.

It is a single variable that specifies each array element. The general declaration of one-dimensional arrays is:

```
dataType  arrayName[arraySize];
```

For example,

```
int    age [10];  
int    num [30];  
float  degree [5];  
char  a [15];
```



The items in an array are called elements (in contrast to the items in a structure which are called members). The elements in an array are of the **same type** only the values vary.

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### Initializing array elements:

The initializing of array can be done in several methods such as:

- The first element of array named **age**: `age [0] = 18;`
- The last element of array **age**: `age [9] = 19;`
- All elements of array **age**:  
`age [10] = { 18, 17, 18 ,18 ,19, 20 ,17, 18 ,16,19 };`
- `int x [ ] = { 12, 3, 5, 0, 11, 7, 30, 100, 22 };`
- `int y [10] = { 8, 10, 13, 15, 0, 1, 17, 22};`

### Accessing array elements:

We can access each array element by written the name of array, followed by brackets delimiting a variable (or constant) in the brackets which are called the array index.

- Accessing the first element of array **num** to variable **x**.  
`x = num [0];`
- Print the second element of the array **age**.  
`cout<<age[1];`
- Accessing the last element of array **num** to variable **y**.  
`y = num [9];`
- `cout << num [0] + num [9];`
- `num [0] = num [1] + num[2];`
- `num [7] = num [7] + 3;`

### Input/print /process array elements:

Herein several C++ codes illustrate how to input, print, and processing of **num** array elements.

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Input	Processing	Printing
<u>cin&gt;&gt;num[10];</u>	sum=0; for (int i=0;i<10;i++){ sum=sum+num[i]; }	<u>cout &lt;&lt; num [4];</u> cout>>num[9]; cout>>num[0]; cout>>num[2]+4;
cin>>num[0]; cin>>num[2];	for (int i=0; i<10; i++){ num[i]=num[i]+1; }	for (int i=0; i<10; i++) { cout << num[ i ]; }
for (int i=0; i<10; i++){ cin>>num[i]; }	num[0]=num[2]+num[3]; num[1]=num[2]*num[3]; num[2]=num[2]*2; num[3]=num[0]+num[5];	if ( num [5] > 5 ) { cout << "greater"; }

Another examples of C++ code:

```
int mark[5] = {19, 10, 8, 17, 9};
```

marks	19	10	8	17	9	Value
	0	1	2	3	4	Index

Now, change 4th element to 50

```
mark[3] = 50;
```

- The result is:

marks	19	10	8	50	9	Value
	0	1	2	3	4	Index

Then, take input from the user and store the input at the third index. Suppose that the input value is **150**.

```
cin >> mark[2];
```

- The result is:

marks	19	10	150	50	9	Value
	0	1	2	3	4	Index

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And, take input from the user and insert it into ith index. Suppose that the value of i is 2 and the input value is 20.

```
cin >> mark[i-1];
```

- The result is:

marks	19	20	150	50	9	Value
	0	1	2	3	4	Index

Print first element of the array

```
cout << mark[0];
```

- The result is:

19

Print ith element of the array. Suppose that the i is 5.

```
cout >> mark[i-1];
```

- The result is:

9

### Ex 1:

- Write a C++ program to read 1-D array and print it.

```
#include <iostream.h>
```

```
#include <conio.h>
```

```
int main()
```

```
{
```

```
    int numbers[5] = {7, 5, 6, 12, 35};
```

```
    cout << "The numbers are: ";
```

```
    for (int i = 0; i < 5; i++)
```

```
    {
```

```
        cout << numbers[i] << " ";
```

```
    }
```

```
    return (0);
```

```
}
```

### Output

The numbers are: 7 5 6 12 35

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### Ex 2.

- Write a C++ program to take **five** inputs from user and store them in an array called **number**. After that, print them.

```
#include <iostream.h>
#include <conio.h>
void main()
{
    int numbers[5];
    cout << "Enter 5 numbers: " << endl;
    for (int i = 0; i < 5; i++)
    {
        cin >> numbers[i];
    }
    cout << "The numbers are: ";
    for (int n = 0; n < 5; n++)
    {
        cout << numbers[n] << " ";
    }
}
```

### Output

Enter 5 numbers:

12

13

14

15

16

The numbers are: 12 13 14 15 16

### Ex 3.

- Write a C++ program to add 1 to all elements of array called **number**. After that, print the result.

```
#include <iostream.h>
void main()
{
    int numbers[5] = {7, 5, 6, 12, 35}, i;
    cout << "The numbers are: ";
    for (i = 0; i < 5; i++)
    {
        cout << numbers[i] << " ";
    }
}
```

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```
for (i = 0; i < 5; i++)
{
    numbers[i]=numbers[i]+1;
}
cout<<"\n";
cout << "The numbers after adding are: ";
for (i = 0; i < 5; i++)
{
    cout << numbers[i] << " ";
}
}
```

### Output

The numbers are: 7 5 6 12 35

The numbers after adding are: 8 6 7 13 36

### Ex 4.

- Write a C++ program to read 4 numbers and print it in reverse order.

```
#include <iostream>
void main()
{
    int a [4],i;
    cout << "Enter 5 numbers: \n";
    for ( i=0; i <4; i++ )
    {
        cout << i << ": ";
        cin >> a [ i ];
        cout << "\n";
    }
    cout << "The reverse order is: \n";
    for ( i =3; i >=0; i-- )
    {
        cout << i << ": " << a [ i ] << endl;
    }
}
```

### Output

Enter 4 numbers:

0: 10

1: 20

2: 30

3: 40

The reverse order is:

3: 40

2: 30

1: 20

0: 10

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### Ex 5.

- Write a C++ program, to find the summation of array elements. Suppose that the size of array is 3.

```
#include <iostream.h>

void main()
{
    int a [3], sum = 0;
    cout << "Enter 3 numbers\n";
    for ( int i =0; i <3; i++ )
    {
        cout << "Enter the number:";
        cin >> a [ i ];
        sum = sum+a [ i ];
    }
    cout << "The sum is: " << sum << endl;
}
```

### Output

```
Enter 3 numbers
Enter the number:7
Enter the number:5
Enter the number: - 1
The sum is: 11
```

### Ex 6.

- Write a C++ program, to split the odd numbers and even numbers of one array into two arrays.

```
void main()
{
    int a [ 10 ]= { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, odd[10], even [10], i , o=0, e=0;
    cout<<"The number of array are:"<<endl;
    for ( i=0 ; i<10; i++ )
    {
        cout<<a[i]<<" ";
    }
    for ( i=0 ; i<10; i++ )
    {
        if (a[i] % 2 !=0)
        {
            odd[o]=a[i];
            o=o+1;
        }
        else
        {
            even[e]=a[i];
            e=e+1;
        }
    }
    cout<<endl;
```

### Output

```
The number of array are:
1 2 3 4 5 6 7 8 9 10
The odd numbers are:
1 3 5 7 9
The even numbers are:
2 4 6 8 10
```



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```
cout<<"The odd numbers are:"<<endl;
for ( i=0 ; i<o; i++ )
{
    cout<<odd[i]<<" ";
}
cout<<endl;
cout<<"The even numbers are:"<<endl;
for ( i=0 ; i<e; i++ )
{
    cout<<even[i]<<" ";
}
}
```

### Ex 7.

- Write a C++ program, to add two arrays. Then, print the result.

```
#include<iostream.h>
int main()
{
    int first[20], second[20], sum[20], c, n;
    cout << "Enter the number of elements:";
    cin >> n;
    cout << "Enter elements of first array" << endl;
    for (c = 0; c < n; c++)
    {
        cin >> first[c];
    }
    cout << "Enter elements of second array" << endl;
    for (c = 0; c < n; c++)
    {
        cin >> second[c];
    }
    cout << "Sum of elements of the arrays:" << endl;
    for (c = 0; c < n; c++)
    {
        sum[c] = first[c] + second[c];
        cout << sum[c] << endl;
    }
}
```

### Output

```
Enter the number of elements: 3
Enter elements of first array
1
2
3
Enter elements of second array
4
5
6
Sum of elements of the arrays:
5
7
9
```

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### Homework:

1. Which command shall we write in order to print the second element of array distance [] = { 23, 7, 1, 4, 6} ?

2. What is the output of the following C++ Program?

```
#include<iostream.h>
void main ( )
{
    int number[3]=[10,2,33]
    number [0]= number[0]+3;
    cout << number [1];
}
```

3. What are the first and last Indexes of the below array?

```
int num [9];
```

4. What is the output of the following C++ Program?

```
#include<iostream.h>
int main()
{
    int ary[4];
    ary[4] = {1,2,3,4};
    cout << ary[2];
    return 0;
}
```

5. What is the output of the following C++ Program?

```
#include<iostream.h>
int main()
{
    int ary[] = {10,20,30},
    for (int i=0;i<3;i++)
        {   cout<< ary[i]+1<<" "; }
}
```

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6. What is the output of the following C++ Program?

```
int main ()
{
    int array[] = {0, 2, 4, 6, 7, 5, 3};
    int n, result = 0;
    for (n = 0 ;n < 8 ;n++) {
        result += array[n];
    }
    cout << result;
}
```

7. Write a c++ code to print the third element of the array age.

8. Suppose that you have the following array.

```
int mark [5] = {19, 10, 8, 17, 9};
change 2nd element to 17.
```

9. What is the output of the following C++ Program?

```
int main ()
{
    int mark[] = {4, 2, 4, 6, 7};
    mark[0]=mark[0]+mark[0];
    mark[1]=mark[1]+mark[4];
    mark[3]=1+mark[4];
    cout<< mark[0]+11<<endl;
    cout<< mark[1] -1<<endl;
    cout<< mark[3]+2 <<endl;
    cout<< mark[4]*2;
}
```

10. Write a C++ program to subtract 1 from all elements of array called degree.

After that, print the result. Suppose that the array has 6 elements.

11. Write a C++ program, to sum the positive numbers of array called degree.

Suppose that the size of array is 5.

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12. Write a C++ program, to sum the negative numbers of array called degree.

Suppose that the size of array is 5.

13. Write a C++ program, to sum the odd numbers of array called degree. Suppose that the size of array is 5.

14. Write a C++ program, to sum the even numbers of array called degree. Suppose that the size of array is 5.

15. Write a C++ program, to split the positive numbers and negative numbers of one array into two arrays (one for positive number and the other for the negative number)

16. Write a C++ program, to find the average of the student. Suppose that the student has 7 degrees.

17. Write a C++ program, to subtract one array from the other array. Then, print the result.

18. Check whether each of the following statements is true or false and correct the false statement.

- The dimension of array num [2] is 2.
- In C++ programming language, in order to print the second element of array named BOOK we must write the command `cout<<BOOK [2];`
- In C++ programming language, we can write the command `int age [3] = {1,2,3};`
- Suppose that we have array called num [4] = {1,2,3,4}. The result of `num [0] +num [2]` is 4.
- Suppose that we have array age [3] = {20,19,12}, we can write a C++ command.  
`cin >> age [ 2];`
- Suppose that we have array salary [3] = {10,20,30} and `sum=1`. The result of `sum=sum+a[1]` is 21.
- Suppose that we have array called money [4] = {1,2,4}. The result of `money [0] +money [2] +1` is 5.