Programming Fundamentals

Week 9

Learning Outcomes:
After this lesson, students will be able to:

- define the term 'array'
- identify arrays in real world settings
- create arrays using manipulative objects
- draw arrays and write matching multiplication equations

Instructions

- Use proper indentation to make your programs readable.
- Use descriptive variables in your programs (Name of the variables should show their purposes)

Array

Introduction

Array :

An array in C/C++ or be it in any programming language is a collection of similar data items stored at contiguous memory locations and elements can be accessed randomly using indices of an array. They can be used to store collection of primitive data types such as int, float, double, char, etc of any particular type. For example

- Snooker balls that have same round shape but in different colour/value
- Bunch of banana has contain only banana in bunch but different in size/value
- You put your favourite song on a repeat mode.
- A book contain pages

But First, recall these concepts that you were taught in the earlier class.

Array Declaration

SYNTAX

```
Type_Name Array_Name[Declared_Size];
```

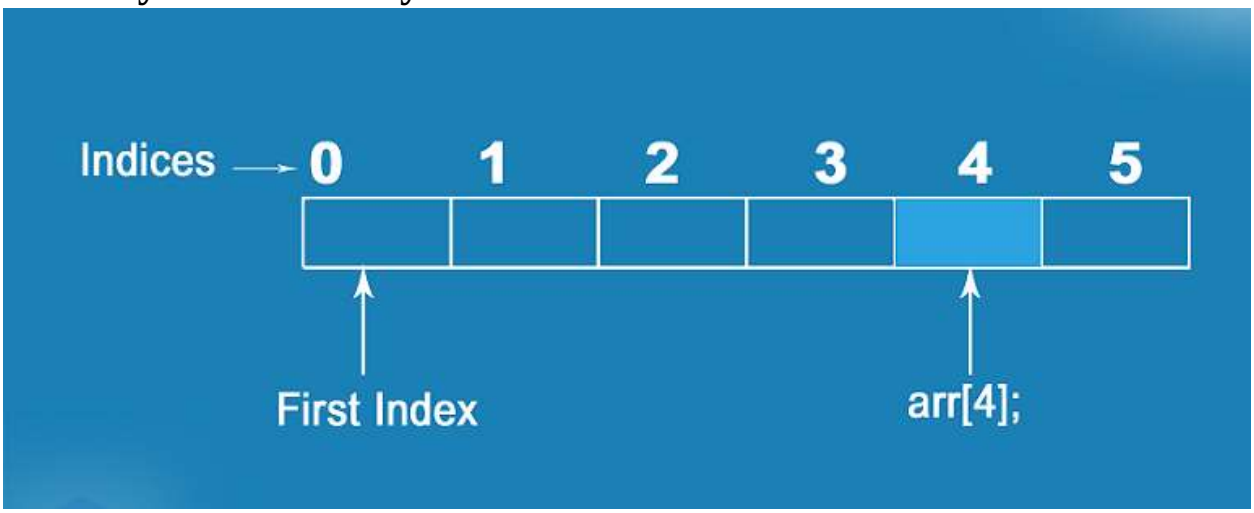
EXAMPLES

```
int bigArray[100];
double a[3];
double b[5];
char grade[10], oneGrade;
```

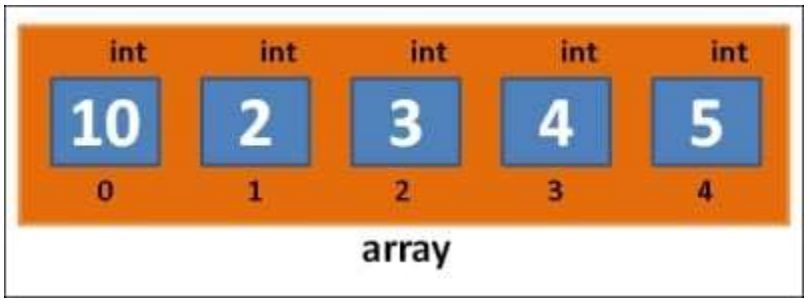
Declaration and initializing of different Type of Array:

a. `int list[] = {18, 13, 14, 16};`
b. `int x[10] = {1, 7, 5, 3, 2, 8};`
c. `double y[4] = {2.0, 5.0, 8.0, 11.0, 14.0};`
d. `double lengths[] = {8.2, 3.9, 6.4, 5.7, 7.3};`
e. `int list[7] = {12, 13, , 14, 16, , 8};`
f. `string names[8] = {"John","Lisa", "Chris", "Katie"};`

Memory View of array with indexes:



Array element with indexes view in Memory



Array :

Example #1:

Write a program that declare an array of 5 elements, initialize them one by one and display them.

Solution

```cpp
#include <iostream>
using namespace std;
int main() {

   int array[5];
   array[0]=10;
   array[1]=20;
   array[2]=30;
   array[3]=40;
   array[4]=50;
   cout<<"1st element at location [0]="<<array[0]<<endl;
   cout<<"2nd element at location [1]="<<array[1]<<endl;
   cout<<"3rd element at location [2]="<<array[2]<<endl;
   cout<<"4th element at location [3]="<<array[3]<<endl;
   cout<<"5th element at location [4]="<<array[4]<<endl;

    }
```

The code produces the following output

```
1st element at location [0]=10
2nd element at location [1]=20
3rd element at location [2]=30
4th element at location [3]=40
5th element at location [4]=50
```

Example #2

Write a program that declare an array of 5 elements, initialize them one by one and display 2nd and 4th elements of an array.

Solution

```cpp
#include <iostream>
using namespace std;
int main() {

   int array[5];
   array[0]=10;
   array[1]=20;
   array[2]=30;
   array[3]=40;
   array[4]=50;

   cout<<"2nd element at location [1]="<<array[1]<<endl;

   cout<<"4th element at location [3]="<<array[3]<<endl;


    }
```

The code produces the following output

```
2nd element at location [1]=20
4th element at location [3]=40
```

Example #3

Write a program that declare an array of 5 elements, initialize them one by one by user input and display 1st and last elements of an array.

Solution

```cpp
#include <iostream>
using namespace std;
int main() {

   int array[5];
  cout<<"enter value for 1st element"<<endl;
  cin>>array[0];
  cout<<"enter value for 2nd element"<<endl;
  cin>>array[1];
  cout<<"enter value for 3rd element"<<endl;
  cin>>array[2];
  cout<<"enter value for 4th element"<<endl;
  cin>>array[3];
  cout<<"enter value for 5th element"<<endl;
  cin>>array[4];

   cout<<"1st element at location [0]="<<array[0]<<endl;

   cout<<"last element at location [4]="<<array[4]<<endl;

    }
```

The code produces the following output

```
enter value for 1st element
23
enter value for 2nd element
54
enter value for 3rd element
65
enter value for 4th element
87
enter value for 5th element
98
1st element at location [0]=23
last element at location [4]=98
```

Example #4:

Write a program that take input from user and store them in an array.

Solution

```cpp
#include <iostream>
using namespace std;

int main() {
    int numbers[5];

    cout << "Enter 5 numbers: " << endl;

    //  store input from user to array
    for (int i = 0; i < 5; ++i) {
        cin >> numbers[i];
    }

    cout << "The numbers are: ";

    //  print array elements
    for (int n = 0; n < 5; ++n) {
        cout << numbers[n] << "  ";
    }

    return 0;
}
```

The code produces the following output

Output

```
Enter 5 numbers:
11
12
13
14
15
The numbers are: 11  12  13  14  15
```

Example #2:

Display sum and average of array element using loop.

Solution

```cpp
#include <iostream>
using namespace std;
int main() {

   int number[]={4,6,7,8,9,20};
   int sum=0;

   double average;
   cout<<"the numbers are: "<<endl;
   for(int i=0;i<6;i++)
   {
    cout<<number[i]<<" ";
    sum=sum+number[i];

   }
   cout<<"\n their sum= "<<sum<<endl;
   average=sum/6.0;
   cout<<"Their average ="<<average<<endl;

    }
```

The code produces the following output

```
The numbers are: 7  5  6  12  35  27
Their Sum = 92
Their Average = 15.3333
```

Example #5:

Write a program that take 10 input from user and store them in an array , program should also asked for number from user and find that number whether exit in store array or not.

Solution

```cpp
#include <iostream>
using namespace std;
int main() {

    int array[10],n,i;
    int flag=0; // flag is indicator,0 mean element not found,1 mean found
    for( i=0;i<10;i++)
    {
        cout<<"enter value"<<endl;
        cin>>array[i];
    }
    cout<<"enter a value you want to find "<<endl;
    cin>>n;
    for(i=0;i<10;i++)
    {
        if(array[i]==n)
        {
            flag=1;
            break;
        }
    }
    if (flag==1)
    cout<<n<<"value found"<<endl;
    else
    cout<<n<<"value not found"<<endl;
    return 0;
        }
```

The code produces the following output

```
enter value
67
enter value
23
enter value
12
enter value
23
enter value
43
enter value
65
enter value
87
enter value
90
enter value
34
enter value
56
enter a value you want to find
90
90value found
```

Example #6:

Write a program that take 10 input from user and store them in an array , program should also asked for scalar value from user and show scalar product operation on array element.

Solution

```cpp
#include <iostream>
using namespace std;
int main () {
   int array[ 10 ];
   int n;
   for ( int i = 0; i < 10; i++ ) {
      cout<<"enter number"<<endl;
      cin>>array[i];
   }
   cout<<"enter scalar number"<<endl;
   cin>>n;
    for ( int j = 0; j < 10; j++ ) {
      cout << array[j] << "\t" << n*array[ j ] << endl;
   }

   return 0;
}
```

The code produces the following output

```
enter number
20
enter number
30
enter number
40
enter number
50
enter number
60
enter number
200
enter number
233
enter scalar number
2
10      20
23      46
12      24
20      40
30      60
40      80
50      100
60      120
200     400
233     466
```

Example #7:

Write a program that take 10 input from user and store them in an array , program should display largest element of an array

Solution

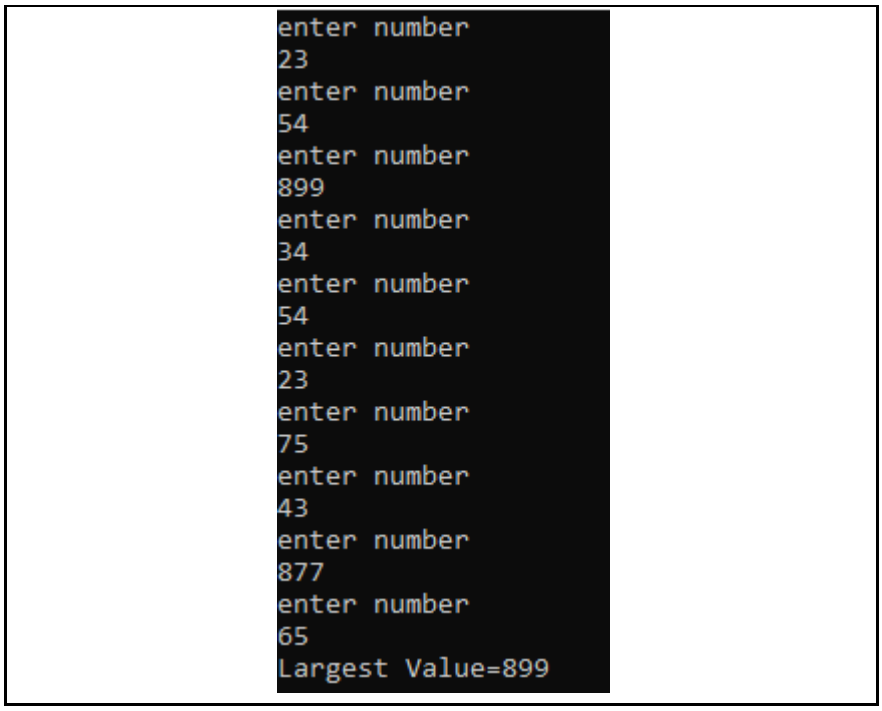
```
#include <iostream>
using namespace std;
int main () {
   int array[ 10];
   int largest;
   for ( int i = 0; i < 10; i++ ) {
    cout<<"enter number"<<endl;
    cin>>array[i];
   }

   largest=array[0];
   for ( int j = 1; j < 10; j++ )
    if(array[j]>largest)
        largest=array[j];

    cout<<"Largest Value="<<largest;


   return 0;
}
```

The code produces the following output



Challenge#1:

Write a program that prompt the user to enter 10 number and store in an array and program should display all elements in reverse order

Input:
2 4 5 6 7 8 3 9 23 21

Output
21 23 9 3 8 7 6 5 4 2

Challenge#2

Write a program that take 10 input from user and store them in an array , program should display smallest element of an array

Input:
21 23 9 1 8 7 6 5 4 2

Output:

1

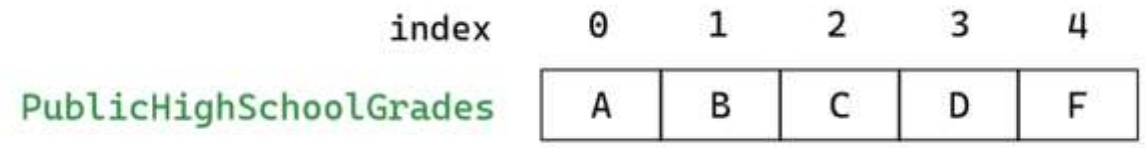
String:

Flow of characters is called string or array of character is called string; every key on the key board is character except special and functional keys. Array of char

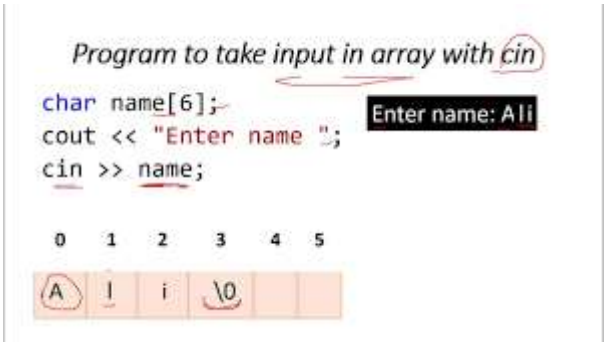
Declaration of Character array:

Here is representation of an character array in memory

```
char PublicHighSchoolGrades[5]= {'A', 'B', 'C', 'D', 'F'};
```



String Input from user using cin:



Example #1:

Write a program that store "Pakistan" in an array and display on the console.

Solution

```cpp
#include <iostream>
using namespace std;
int main() {

    char pk[]="Pakistan";

    cout<<pk;
    return 0;

    }
```

The code produces the following output

```
Pakistan
```

Example #1:

Write a program that store "Pakistan" in an array and display the location of all alphabets in array .

Solution

```cpp
#include <iostream>
using namespace std;
int main() {

   char pk[]="Pakistan";

   cout<<"at 0 location="<<pk[0]<<endl;
   cout<<"at 1 location="<<pk[1]<<endl;
   cout<<"at 2 location="<<pk[2]<<endl;
   cout<<"at 3 location="<<pk[3]<<endl;
   cout<<"at 4 location="<<pk[4]<<endl;
   cout<<"at 5 location="<<pk[5]<<endl;
   cout<<"at 6 location="<<pk[6]<<endl;
   cout<<"at 7 location="<<pk[7]<<endl;
   return 0;

   }
```

The code produces the following output

```
at 0 location=P
at 1 location=a
at 2 location=k
at 3 location=i
at 4 location=s
at 5 location=t
at 6 location=a
at 7 location=n
```

Challenge#1

Write a program that store "hello" and display in reverse order as "olleh"

Challenge # 2:

Write a C++ function to change every letter in a given string with the letter following it in the alphabet (ie. a becomes b, p becomes q, z becomes a).

For Example:

Input: aslam

Ouput: btmbn

Challenge#3:

Write a C++ function to capitalize the first letter of each word of a given string. Words must be separated by only one space.

Example:

Sample Input: cpp string exercises

Sample Output: Cpp String Exercises

Challenge#4:
Write a C++ function to count all the vowels in a given string.
Example:
Sample Input: eagerer
Sample output: number of vowels: 4

Congratulations, you have performed all basics the tasks of an array