EXERCISE

Q1. Select the best answers for the following MCQs

i. **Which of the following is correct declaration of array?**

a. Int arr
b. Int arr {10}
c. Int arr [10
d. Int arr (10)

ii. **What is the index number of the last elements of an array with 5 element?**

a. 5
b. 4
c. 0
d. 6

iii. **What is an array?**

a. An array is a series of elements
b. An array is a series of elements of the same typed placed in noncontiguous memory locations
c. An array is a series of elements of the same type placed in contiguous memory locations
d. None of the above

iv. **What of the following identifies the first elements in array name temp?**

a. Temp [0]

b. Temp [1]

c. Temp (1)

d. Temp (0)

v. **Which of the following identifies the last elements of array declared as int a[10][10]**

a. A[10[10]

b. A[9][10]

c. A[11][11]

d. A[9][9]

vi. **Given the following**

Int k[3][5] =

{{3, 10, 12, 27, 12}

{21, 20, 18, 25, 1}

{15, 16, 17, 44, 4}}

What is in k [1][3]?

a. 12

b. 18

c. 25

d. 15

vii. **Given the following**

Int arr [3][4]=

{{12, 0, 5, 10}

{7, 8, 19, 30}

{33, 1, 2, 22}

Which of the following statements will replace 19 with 50?

a. Arr[2][3] = 50

b. Arr[1][2] = 50

c. Arr [2][1] = 50

d. Arr [19] = 50

viii. Which of the following functions is used to appends a string onto the end of another string?

a. Strcpy ()

b. Strcat ()

c. Strlen ()

d. Strcmp ()

Answers

i.	Int arr [10]	ii.	4
iii.	An array is a series of elements of the same type places in contagious memory location	iv.	Temp [0]
v.	A [9][10]	vi.	25
vii.	Arr [1][2]=50	viii.	Strcat ( )

SHORT QUESTION

Q2. Give short answers of the following questions

i. Define array and give its advantages in programming

Answer

Array

An array is a collection of same type of elements stored in contiguous memory locations

Advantages in Programming

Array allows programmer to use a single variable name to represent a collection of same type of data. This reduces the program size provides an easy way of handling list of numbers or strings and makes computer programming task simple and easy.

ii. Differentiate between one dimensional and two dimensional array.

Answer

Difference

Basic for comparison	One-dimensional	Two-dimensional
Basic	Store single list of elements of similar data type	Store 'list of lists' or 'array of arrays' or 'array of one dimensional array'
declaration	Variable_name [size];	Variable_name [size1] [size2];
Receiving parameter	It can be received in a pointer sized array or an un-sized array	Parameter receiving it must define the rightmost dimension of an array

iii. What is the purpose of size() function? Give one example

Answer

Purpose of sizeof() Function

The sizeof() function provides the number of bytes occupied to store values for data type named within the parenthesis. It is used to determine the amount of storage reserved for int, float, double , char etc data types.

Example

```
#include<iostream>
Using namespace std:
Int main()
{
Cout<<"Size of char:          <<size of(char)  <<"bytes" << end1;
Cout<<"size of int:"          <<size of(int) << "bytes"<< end1;
Cout<<size of float           << size of (float) << "bytes"<< end1;
Cout<< size of double         << size of (double) << "bytes"<< end1;
Return 0:
}
```

Output of the Program

Size of char: 1 byte

Size of int: 4 bytes

Size of float: 4 bytes

Size of double: 8 bytes

iv. Declare an array named x, that has 3 rows and 5 columns and assigned it values from 1 to 15 in the declaration statement

Answer

```
#include<iostream>

Using namespace std:

Int main()

{

Int x[3][5] = {{1, 2, 3, 4, 5}, {6, 7, 8, 9, 10} , {11, 12, 13, 14, 15}

Cout << "values are " << end1;

For (int i=0: i<3: i+=)

{

    For(int j=0, j<5: j++)

        {

        Cout<<"x{"<<i<<"}{"<<j<<"} ";

        }

    }

}
```

v. Define string and explain how it is stored in computer memory

Answer

String

String is a sequence of characters. In C++ characters string is stored in a one dimensional array of char data type. Each element of character string holds one character

Storage of String in Computer Memory

The following diagram shows how the string variable weekday is represented in computer memory

index	0	1	2	3	4	5	6	7	8	9
variable	S	u	n	d	a	y	\0			

The index starts from zero. The compiler automatically places the null character (/0) after the last character. The remaining three characters are not used.

vi. **What is the advantage of using cin.get() function over cin statement for reading a string?**

Answer

Advantage

The advantage of Cin.get() function over cin statement for reading a string is that Cin.get() function whole line then consumes the end of line character so that repeating this will read the next line. When statement considers a space as terminating character. The cin statement reads strings that consist word. Anything typed after a space is ignored.

vii. **Differentiate between Strcpy() and Strcmp() function**

Answer

Difference

Strcy () Function	strcmp() Function
The strcpy() function is used to copy contents of a string variable or string constant to another string variable	The Strcmp() function compares two strings returns an integer value based on the result comparison. This

	comparison is based on ASCII code of characters

viii. Differentiate between Strlen() and Strcat() functions.

Answer

Difference

Strlen() function	Strcat() function
The Strlen() function is used to return the length (the number of characters) of a string	The Strcat() function is used for concentration joining of two strings

EXTENSIVE QUESTIONS

Q3. Write long answers of the following questions

1. What is an array? Explain one dimensional array in detail with one example

Answer

Array

An array is a collection of same type of elements stored in contiguous memory locations

Array allows programmer to use a single variable name to represent a collection of same type of data reduces the program size provides an easy way of handling list of number or strings and makes comp programming task simple and easy. In C++ an array is denoted as follows

Array_name[array_size]

One dimensional array

A one dimensional array is a group of elements having the same datatype and same name. Individual elements are referred to using common name and unique index of the elements

The simplest form of an array is one dimensional array. The array itself is given name and its elements referred to by their subscripts

Declare one Dimensional Array in C++

Here is the general form to declare one dimensional array in C++

Data_type array_name[array_size];

Here, data_type is any valid C++ data type, array_name is the name of the array_size is the size of array. Here is an example declaring array named arr of int type, having maximum element size of 10 elements

Int arr[10];

C++ One dimensional Array Example

Int arr[10] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

C++ One Dimensional Array

```
/*C++ One Dimensional Array */

#include<iostream.h>

#include<conio.h>

Void main()

{

Clrscr();

Int arr[5] = {1, 2, 3, 4, 5};
```

```
Int I:
For (i=0: i<5: i++)
{
        Cot<<"arr[""<<i<<"]       "<<arr[i]<<"\n":
}
        Getch():
}
```

Output of the program

Here is the sample output of this C++ program

Arr [0] = 1

Arr [1] = 2

Ar [2] = 3

Arr [3] = 4

Arr [4] = 5

ii. Explain two dimensional array in detail with one example

Answer

Two Dimensional Array

A two dimensional array uses a single variable name to represent a collection of same type of data in the form of a table or matrix. It has two dimensions i.e. vertical and horizontal dimensions

Example

A two dimensional array a that has three rows and five columns Is shown below

	Column 0	Column 1	Column 2	Column 3

Row0	A[0][0]	A[0][1]	A[0][2]	A[0][3]
Row 1	A[1][0]	A[1][1]	A[1][2]	A[1][3]
Row 2	A[2][0]	A[2][1]	A[2][2]	A[2][4]

Explanation

Each cell in the table represents an element of the array in the form of a[row][col] where row and col written within square brackets are indices. The first index row represents the row number and second index col represents the column number that uniquely identify each element of a. the indices row and col are always integer values and start from zero. For example a[1][3] will identify the element in second row and fourth column

Defining a two Dimensional Array

To define a two dimensional array in C++ the type of the elements the name of the array and the number of elements it is required to store in rows and columns

General form

The following is the general form of declaration of two dimensional array

Datatype arrayname [rowsize] [columnsize] ;

Here datatype is a valid data type (such as integer, float etc) array name is the name of array are rowsize and columnsize enclosed within square brackets specify the number of rows and columns in the two dimensional array.

Example

The following statement declares an array called a hat can store marks of 3 students of 5 tests

Int a[3][5];

The rowsize which is 3 represents the number of students and columnsize which is 5 represents the number of tests. In C++ indices always start from zero. Therefore,

the student number will be in the range of 0 to 2 and test number will be in the range of 0 to 4

Initializing a two Dimensional Array

Just like one dimensional array two dimensional array can also be initialized in declaration statement

Example

The following statement declares and initializes a two dimensional array called 'a' that has 3 rows and 4 columns and assigns values to it

```
Int a[3][4] =
{
        {45, 66, 39, 72}        // Elements of first row
        {87, 50, 56, 63}        // Elements of second row
        {44, 23, 53, 38}        // Elements of third row
};
```

Here nested braces are used for assigning values to each row of the array. This statement can be written on a single line as

```
Int a[3][4] = {{45, 66, 39, 72}, {87, 50, 56, 63}, {44, 23, 58, 88}}'
```

The above statement can also be written using a single set of braces as shown below

```
Int a[3][4] = {45, 66, 39, 72, 87, 50, 56, 63, 44, 23, 58, 88};
```

The following statement initializes a two dimensional array of type float with 5 rows and 2 columns

```
Float weight [5][2]=
{
```

```
{3.40, 2.75},        // Elements of first row
{4.75, 3.28},        // Elements of second row
{8.10, 6.22},        // Elements of third row
{4.71, 3.92},        // Elements of fourth row
{1.43, 7.25},        // Elements of fifth row
};
```

iii. What are string? How strings are defined in C++? Give examples

Answer

String

String is a sequences of characters. In C++ character string is stored in a one dimensional array of char data type. Each element of character string holds one character. String is most commonly used item in computer programming to represent name, address, object, book title etc

Null character

All the strings end with a special character known as null character and it is represented by '\0'. The null character is automatically appended at the end of string

Define a string

To define a string in C++ the data type char the name of string and the number of character it is required to store is mentioned in the declaration statement

General form

The following is the general form of declaration statement

Char stringname [stringsize];

Explanation

The char keyword lets the compiler know that a variable of type character is declared. The string name is the name of the string variable. It follows the same name rules of other type of variables. The stringsize enclosed within square brackets specifies the number of characters that can be stored in the string

Note: since the null character is appended at the end of string. If a string has n character then the stringsize should be at least n+1.

Example

The following statement declares a string called weekday that can hold maximum 10 characters including one for the null characters

Char weekday[10];

Example 2

The following statement declares a sting called studentname that can hold 20 character including one for the null character

Char studentname[20];

iv. **Explain the purpose of the following string functions:**

Strcpy(), Strcat(), Strlen(), strcmp()

Answer

Strcpy() function

The Strcpy() functions is used to copy contents of a string variable or string constant to another string variable

General form

The general form of Strcpy() function is

Strcpy(string2, string1)

It has two arguments string 1 and string2, which are string variables when it is executed content of string 1 will be copied to string2

Example

```
Char string[10;="ISLAMABAD"

String2[10], string3[10]

Strcpy(string2, string1),

Cout<<"string1="<<string2<<End1:

Strcpy(string3, "PAKISTAN")

Cout<<"string3="<<string3<<End1:
```

Output of the Program

The output of the above code will be

String 2= ISLAMABAD

STRING3= Pakistan

2. **STRCAT()Function**

   The Strcat() function is used for concatenation or joining of two string

General Form

The general form of Strcat() function is

Strcat(string1, string2):

When this function is executed it will append (concatenate) string2 onto the end of string1

Example

```
Charstring1[10], string2[10]:

Strcpy(string1, "HOME"):
```

```
Strcpy (string2, "WORK");

Strcat(string1, string2);

Cout<<"string1=",<<string1<<end1;
```

Explanation

When the above code is executed the first Strcpy() function will copy the string "HOME" to string variable string1 and the second Strcpy() function will copy the string "WORK" to string variable string2. The Strcat() function will append the string2 onto the end of string 1

Output of the Example

The output of the above code will be

```
String1 HOMRWORK
```

3. Strlen() Function

The Strlen() function is used to return the length (the number of characters) of a string

General form

The general form of Strlen() function is

```
strlen(string);
```

example

here string is a string variable. For example

```
char string [10] "COMPUTER";

cout<<"the number of character in the string is
Strlen(string)<< end1;
```

Output of the Example

The output of the above code will be

The number of character in the string is 8

Program-Demonstrates the use of Strlen() function

```
#include<iostream.h>
#include<conio.h>
#include<string.h>
Void main()
{
Char city1= "LAHORE", city 2= "ISLAMABAD", city3= "KARACHI":
Cout<<"Characters in city1 are: <<Strlen(city1)<<end1:
Getch()
}
```

Output of the Program

The output of the program will be

Characters in city 1 are: 6

Characters in city2 are: 9

Characters in city3 are: 7

4. **Strcmp() function**

   The strcmp() function compares two strings and returns an integer value based on the result of comparison. This comparison is based on ASCII codes of characters.

General Form

The general form of strcmp() function is

Strcmp(string1, string2);

Explanation

When it is called it will compare the first characters of string 1 and string 2 if they are the same it will compare the second part of characters. The comparison will continue until the characters differ or a terminating full characters is reached during comparison A is considered less than B and B is considered less than C and so on. The function will return the following integer values based on the result of comparison

LAB ACTIVITIES

i. **Practice all the programs given in the chapter**

Answer

Practical work

ii. **Write a program that reads ten numbers in an array and prints them in reverse order.**

Program

```
#include<iostream>
Using namespace std:
Int main()
{
Int arr[10], i, j, temp:
Cout<<"Enter array elements";
For (i=0; i<10; i++)
```

```
{
        Cin>>arr[i];
}
J= i, 1
i= 0;
while (i<j)
{
        Temp=ar[i];
        Arr[i]=arr[j];
        Arr[j]=temp;
         i++;
        j++
}
 Cout<<"Now the reverse order of the Array is \n";
        For(i=0; i<!0; i++)
        {
                Cout<<arr[i];
        }
}
```

iii. **Write a program that reads ten numbers and print the smallest along with its index**

Program

```
#include<iostream>
Using namespace std:
Int main()
{
        Int array [10], index:
          For (int i=1; i<=10; i++)
// counts to 10 and prompts the user for a value and stores it
      {
            Cout<<"Enter value << i<<
            Cin>> array [i]:
       }
Int smallest = array[0]:
Index=0:
Int i:
For (i=1, i<=10, i++)
    {
    If (smallest > array[1])
       {
        Smallest>array[1])
             {
        Smallest array [i]:
    Index= i:
}
```

```
    }
Cout<<"The smallest number with its index << index << is
        <<smallest<<End1;
}
```

iv. For the given array:

Int arr[15] = {4, 8, 5, 1, 3, 5, 0, 12, 5, 7, 3, 15, 8, 4, 11}

Write a program that prints the number of times the number 5 appears in the array

Program

```
#include<iostream>
Using namespace std;
// Count the number of occurrence of the digits 5 in array;
Int main()
{
   Int arr[15] = {4, 8, 5, 1, 3, 5, 0, 12, 5, 7, 3, 15, 8, 4, 11};
   Int counter =0 ;
   For {int i=o; i<15; i++)
   {
        If (arr[i]   5)
        {
          Counter += 1;
        }
}
```

```
Cout << "Occurrence of 5 is << counter <<end 1;
}
```

v. For the given array

Int a[3][2]= {{6,3}, {7,8}, {4,5}};

Write a program that displays all the elements in the form of a matrix as shown below and find its sum

6 3

7 8

4 5

Program

```
#include<iostream>
Using namespace std;
// Show array in matrix and its sum;
Int main()
{
   Int a[3][2] = {{6, 3} , {7, 8}, {4, 5}};
   Int sum = 0;
   // show in matrix
   Cout<< end1 << "\t" << "Matrix form" << end1 << end1;
   For (int i=0; i<3; i++)
   {
      For (int j=0; j<2; j++)
      {
```

```
            Cout<< "\t" <<      <<a[1][j];
        }
        Cout << end1
}
//sum of numbers,
For (int i=0; i<3; i++)
{
      For (int j=0; j<2; j++)
      {
        Sum += a[i][j]
       }
}
 Cout<< "Sum is       << sum << end1;
}
```

vi. For the given array:

```
Int arr[3][4]=
                {{4, 18, -16, 11}
                 {-5, 10, -2, 12}
                 {15, -3, 17, 18}};
```

Write a program to find the sum of positive numbers

Program

```
#include<iostream>
```

```
Using namespace std:

Int main()

{

    Int arr[3][4]     {{4, 18, -16, 11}, {5, 10, -2, 12}, {15, -3, 17, 18}},

    Int sum = 0:

For (int i=0; i<3; i++)

{

   For (int j=0; j<$, j++)

{

   If (arr[1][j] > o)

{

      Sum += arr[i][j]:

}

    }

}

Cout<< "Sum of the positive numbers are " << sum << end1;

}
```

vii. For the given array:

Int a[2][4] = {14, 8, 11, 10}, {15, 12, 20, 3}

B[2][4]= {2, 3, 4, 7}, {6, 7, 8, 9}};

Write a program that adds the two arrays and produces the following output

Sum of two arrays is:

16 11 15 17

21 19 28 12

Program

```
#include<iostream>;

Using namespace std;

Int main()

{

Int a[2][4] = {{14, 8, 11, 10}, {15, 12, 20, 3}};

Int b[2][4] = {{2, 3, 4, 7}, {6, 7, 8, 9}};

Int sum [2][4]

Int I, j;

Cout<< end1;

/ calculate sum

For (i=0; i<2; i+=)

{

        For (j=0; j<$; j++)

        {

        Sum[i][j] = a[i][j] + b[i][j]

        }

}

Cout << end1;

Cout << end1 << "sum of two arrays is: "<< end1;

For (i=0; i<2; ++i)

For (j=0; j<4; ++j)
```

```
{
    Cout<< sum [i][j] << " " ;
    If( j == 4 -1)
        Cout<< end1;
}
```

viii. Input data from keyboard in a two dimensional array x, that has r row and c columns and print the sum of each row in the following format.

Sum of row 1=

Sum of row 1=

*

*

Sum of row r =

Program

```
#include<iostream>
Using namespace std;
Int main()
{
    Int r, c, row sum;
      Cout << "Enter rows";
    Cin >> r;
    Cout << "Enter columns";
```

```
        Cin>> c:
Cout << end1;
For (i=0; i<r; i++)
{
        Row sum=0
        For (j=0; j<c; j++)
        }
        Cout << "Sum of row" << i << "=" << rowsum << end1;
  }
  Cout << end1;
}
```

ix. **Write a program that reads a string. Copies it into another string and then prints both strings**

Program

```
#include<iostream>
#include<conio.h>
#include<string.h>
Using namespace std;
Int main()
{
 Char s1[10], s2[10];
Clrscr():
```

```
Cout<<"Enter string s1":
Cin>>s1;
Strcpy (s2, s1):
Cout<<"string s2: "<<s2;
Return 0;
}
```

x. Write a program that reads 2 strings of size 20 and perform the following operations.

a. Print both strings with their length

Program

```
#include<iostream>
Using namespace std:
Int main)
String s1, s2:
Cout<<"Enter the first string:"<< end1;
Cin>>s1:
Cout<<"Enter the second string: "<< end1;
Cin>>s2;
Cout<<"Length of first string is: "<<s1, length() << end1
Cout<<"Length of second string is: << s2. Length () << end1:
}
```

xi. Concentrate the second string onto the end of first string and print it

Program

```
#include<iostream>

Using namespace std:

Int main()

{

    String s1, s2:

    Cout<< "Enter the first string: <<end1;

    Cin>> s1:

    Cout<< "Enter the second string: <<End1:

    Cin>>s2:

    String cant = s1 + s1;

    Cout << end1 << "Concentration of both strings << cant << end1;

}
```