General Instructions:

(i) All questions are compulsory.
(ii) Programming Language: C++

1. (a) What is the significance of inline function in C++?  
(b) Name the header files to which the following belong:
   (i) floor()  
   (ii) strcmp()  
(c) Rewrite the following program after removing the syntactical error(s), if any. Underline each correction.
   ```cpp
   #include <iostream.h>
   const int Multiple 3;
   void main ()
   {
   Value=15;
   for ( int Counter = 1; Counter=<5; Counter++, Value+=2)
   if (Value%Multiple==0)
   cout<<Value * Multiple;
   cout<<endl;
   else
   cout<<Value+Multiple<<endl;
   }
   ```

(d) Find the output of the following program:
   ```cpp
   #include <iostream.h>
   #include <conio.h>
   int a = 5;
   void fun (int & x, int y, int *z)
   {
   a += x;
   y *= a;
   *z = a+y;
   cout <<a<<","<<x<<","<<y<<endl;
   ```
(e) Find the output of the following program:

```cpp
void main()
{
    clrscr();
    int a = 9, b = 6;
    fun(a, a, &b);
    cout << a << "" << b << "" << "" << "\n";
    getch();
}
```

(f) Observe the following program SCORE.CPP carefully, if the value of Num entered by the user is 5, choose the correct possible output(s) from the options from (i) to (iv), and justify your option.

```cpp
//program: SCORE.CPP
#include<stdlib.h>
#include<iostream.h>
void main()
{
    randomize();
    int Num, Rndnum;
    cin>>Num;
    Rndnum = random(Num) + 5;
    for (int N = 1; N<=Rndnum; N++)
        cout<<N<<""","";`
2. (a) Define the term Data Hiding in the context of Object Oriented Programming. Give a suitable example using a C++ code to illustrate the same.

(b) Answer the questions (i) and (ii) after going through the following class:

```cpp
class Test {
    char Paper[20];
    int Marks;
    public:
    Test() // Function 1
    {
        strcpy(Paper, "Computer");
        Marks = 0;
    }
    Test (char P[]) // Function 2
    {
        strcpy(Paper, P);
        Marks = 0;
    }
    Test (int M) // Function 3
    {
        strcpy(Paper, "Computer");
        Marks = M;
    }
    Test (char P[], int M) // Function 4
    {
        strcpy(Paper, P);
        Marks = M;
    }
};
```
(i) Which feature of Object Oriented Programming is demonstrated using Function 1, Function 2, Function 3 and Function 4 in the above class Test?

(ii) Write statements in C++ that would execute Function 2 and Function 4 of class Test.

(c) Define a class RESORT in C++ with following description:

Private Members:

Rno //Data member to store Room No.
Name //Data member to store customer name.
Charges //Data member to store per day charges.
Days //Data member to store number of days of stay.

COMPUTE() //A function to calculate and return Amount as Days*Charges
//and if the value of Day*Charges is more than 11000 then as
//1.02*Days*Charges

Public Members

Getinfo() //A function to enter the content Rno, Name, Charges and Days
Dispinfo() //A function to display Rno, Name, Charges, Days and Amount
//(Amount to be displayed by calling function COMPUTE())

(d) Answer the questions (i) to (iv) based on the following code:

```
class Medicines
{
    char Category [10];
    char Date_of_manufacture[10];
    char Company [20];
    public:
        Medicines ();
        void entermedicinedetails();
        void showmedicinedetails();
};

class Capsules: public Medicines
{
    protected:
        char capsule_name [30];
```
char Volume_label [20];
public:
float Price;
Capsules();
void entercapsuledetails();
void showcapsuledetails();
};
class Antibiotics: public Capsule
{
int Dosage_units;
char Side_effects [20];
int Use_within_days;
public:
Antibiotics ();
void enteredetails();
void showdetails();
};

(i) How many bytes will be required by an object of class Medicines and an object of class Antibiotics respectively?

(ii) Write names of all the member functions accessible from the object of class Antibiotics.

(iii) Write names of all the members accessible from member functions of class Capsules.

(iv) Write names of all the data members, which are accessible from objects of class Antibiotics.

3. (a) Write a function SORTSCORE() in C++ to sort an array of structure. Examinee in descending order of Score using Bubble Sort.

Note: Assume the following definition of structure Examinee.

struct Examinee
{
    long RollNO;
    char Name[20];
    float Score;
};

Computer Science/XII [5]

[P.T.O.]
Sample Content of the array (before sorting)

<table>
<thead>
<tr>
<th>RollNo</th>
<th>Name</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>Ravyank Kapur</td>
<td>300</td>
</tr>
<tr>
<td>1005</td>
<td>Farida Khan</td>
<td>289</td>
</tr>
<tr>
<td>1002</td>
<td>Anika Jain</td>
<td>345</td>
</tr>
<tr>
<td>1003</td>
<td>George Peter</td>
<td>297</td>
</tr>
</tbody>
</table>

Sample Content of the array (after sorting)

<table>
<thead>
<tr>
<th>RollNo</th>
<th>Name</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1002</td>
<td>Anika Jain</td>
<td>345</td>
</tr>
<tr>
<td>1001</td>
<td>Ravyank Kapur</td>
<td>300</td>
</tr>
<tr>
<td>1003</td>
<td>George Peter</td>
<td>297</td>
</tr>
<tr>
<td>1005</td>
<td>Farida Khan</td>
<td>289</td>
</tr>
</tbody>
</table>

(b) An array Arr[5][35] is stored in the memory along the column with each of its elements occupying 8 bytes. Find out the base address and the address of an element Arr[2][5], if the location Arr[5][10] is stored at the address 4000.

(c) Write a function in C++ to perform a PUSH operation in a dynamically allocated stack considering the following:

```cpp
struct Node
{
    int x, y;
    Node *Link;
}:

class STACK
{
    Node *ToP;
    public:
    STACK () {Top=NULL;}
    void PUSH();
    void POP();
    ~STACK();
};
```

(d) Write a function in C++ to print the sum of all the values which are either divisible by 2 or are divisible by 3 present in a two-dimensional array passed as the argument to the function.
(e) Evaluate the following postfix notation of expression:

\[ 10 \ 20 \ + \ 25 \ 15 \ - \ 30 \ / \]

4. (a) Observe the program segment given below carefully, and answer the question that follows:

```cpp
class Book
{
    int Book_no;
    char Book_name [20];
    public:
        // function to enter Book details
        void enterdetails( );
        // function to display Book details
        void showdetails( );
        // function to return Book_no
        int Rbook_no( ) [return Book_no;]
    };
    void Modify(Book NEW)
    {
        ifstream File;
        File.open ("BOOK. DAT", ios:: binary | ios:: in | ios:: out);
        Book OB;
        int Recordsread = 0, Found = 0;
        while (!Found && File.read((char*)&OB, sizeof(OB)))
        {
            Recordsread ++;
            if (NEW.RBook_no() == OB.RBook_no())
            {
                ...................... //Missing Statement
                File.write((char*)&NEW, sizeof(NEW));
                Found = 1;
            }
        }
        else
        File.write((char*)&OB, sizeof(OB));
    }
    if (!Found)
```
cout<<"Record for modification does not exist";
File . close();
}

If the function Modify( ) is supposed to modify a record in file BOOK.DAT with the values of Book NEW passed to its argument, write the appropriate statement for **Missing Statement** using seekp( ) or seekg( ), whichever needed, in the above code that would write the modified record at its proper place.

(b) Write a function in C++ to count and display the number of lines starting with alphabet 'A' present in a text file "LINES.TXT".

Example:

If the file "LINES.TXT" contains the following lines,

"A boy is playing there.
There is a playground.
An aeroplane is in the sky.
Alphabets and numbers are allowed in the password."
The function should display the output as 3.

(c) Given a binary file STUDENT.DAT, containing records of the following class

```cpp
class Student
{
    char S_AdmNo[10]; //Admission number of student
    char S_Name[30];  //Name of student
    int percentage;  //Marks Percentage of student
public:
    void EnterData ( )
    {
        gets (S_AdmNo); gets(S_Name); cin>>Percentage;
    }
    void DisplayData ( )
    {
        cout<<setw(12) <<S_AdmNo;
        cout<<setw(32) <<S_Name;
        cout<<setw(3) <<Percentage<<endl;
    }
};
```
int ReturnPercentage() {return Percentage;};

Write a function in C++, that would read contents of file STUDENT.DAT and display the details of those Students whose Percentage is above 75.

5. (a) What do you understand by the terms Primary Key and Candidate key of a relation in relational database?

(b) Consider the following tables EMPLOYEES and EMPSALARY. Write SQL commands for the statements (i) to (iv) and give outputs for SQL queries (v) to (viii).

**EMPLOYEES**

<table>
<thead>
<tr>
<th>EMPID</th>
<th>FIRSTNAME</th>
<th>LASTNAME</th>
<th>ADDRESS</th>
<th>CITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>010</td>
<td>George</td>
<td>Smith</td>
<td>83 First Street</td>
<td>Howard</td>
</tr>
<tr>
<td>105</td>
<td>Mary</td>
<td>Jones</td>
<td>842 Vine Ave.</td>
<td>Losantiville</td>
</tr>
<tr>
<td>152</td>
<td>Sam</td>
<td>Tones</td>
<td>33 Elm</td>
<td>St. Paris</td>
</tr>
<tr>
<td>215</td>
<td>Sarah</td>
<td>Ackerman</td>
<td>440 U.S. 110</td>
<td>Upton</td>
</tr>
<tr>
<td>244</td>
<td>Manila</td>
<td>Sengupta</td>
<td>24 Friends Street</td>
<td>New Delhi</td>
</tr>
<tr>
<td>300</td>
<td>Robert</td>
<td>Samuel</td>
<td>9 Fifth Cross</td>
<td>Washington</td>
</tr>
<tr>
<td>335</td>
<td>Henry</td>
<td>Williams</td>
<td>12 Moore Street</td>
<td>Boston</td>
</tr>
<tr>
<td>400</td>
<td>Rachel</td>
<td>Lee</td>
<td>121 Harrison</td>
<td>New York</td>
</tr>
<tr>
<td>441</td>
<td>Peter</td>
<td>Thompson</td>
<td>11 Red Road</td>
<td>Paris</td>
</tr>
</tbody>
</table>

**EMPSALARY**

<table>
<thead>
<tr>
<th>EMPID</th>
<th>SALARY</th>
<th>BENEFITS</th>
<th>DESIGNATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>010</td>
<td>75000</td>
<td>15000</td>
<td>Manager</td>
</tr>
<tr>
<td>105</td>
<td>65000</td>
<td>15000</td>
<td>Manager</td>
</tr>
<tr>
<td>152</td>
<td>80000</td>
<td>25000</td>
<td>Director</td>
</tr>
<tr>
<td>215</td>
<td>75000</td>
<td>12500</td>
<td>Manager</td>
</tr>
<tr>
<td>244</td>
<td>50000</td>
<td>12000</td>
<td>Clerk</td>
</tr>
<tr>
<td>300</td>
<td>45000</td>
<td>10000</td>
<td>Clerk</td>
</tr>
<tr>
<td>335</td>
<td>40000</td>
<td>10000</td>
<td>Clerk</td>
</tr>
<tr>
<td>400</td>
<td>32000</td>
<td>7500</td>
<td>Salesman</td>
</tr>
<tr>
<td>441</td>
<td>28000</td>
<td>7500</td>
<td>Salesman</td>
</tr>
</tbody>
</table>
(i) To display Firstname, Lastname, Address and City of all employees living in Paris from the table EMPLOYEES.

(ii) To display the content of EMPLOYEES table in descending order of FIRSTNAME.

(iii) To display the Firstname, Lastname, and Total Salary of all Managers from the tables EMPLOYEES and EMPSALARY, where Total Salary is calculated as Salary + Benefits.

(iv) To display the Maximum salary among Managers and Clerks from the table EMPSALARY.

(v) SELECT FIRSTNAME, SALARY
    FROM EMPLOYEES, EMPSALARY
    WHERE DESIGNATION = 'Salesman' AND
    EMPLOYEES. EMPID = EMPSALARY. EMPID;

(vi) SELECT COUNT(DISTINCT DESIGNATION) FROM EMPSALARY;

(vii) SELECT DESIGNATION, SUM (SALARY)
      FROM EMPSALARY
      GROUP BY DESIGNATION HAVING COUNT(*) > 2;

(viii) SELECT SUM (BENEFITS)
       FROM EMPLOYEES
       WHERE DESIGNATION = 'Clerk';

6. (a) State and verify algebraically involution law in Boolean Algebra.

(b) Write the equivalent Boolean expression for the following Logic Circuit: 2

[ Image of the logic circuit diagram ]
(c) Write the SOP form of a Boolean Function \( F \), which is represented by the following truth table:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

(d) Reduce the following Boolean expression using K-Map:

\[ F(A, B, C, D) = \sum(0, 1, 2, 3, 4, 5, 10, 11, 15) \]

7. (a) What is the difference between Message Switching technique and Packet Switching technique? 1

(b) Expand the following terminologies:

- TCP/IP
- XML
- CDMA
- WLL

(c) Write two applications of Cyber Law. 1

(d) The Great Brain Organisation has set up its new Branch at Srinagar for its office and web based activities. It has 4 Wings of buildings as shown in the diagram:

<table>
<thead>
<tr>
<th>Distance</th>
<th>Wing X to Wing Z</th>
<th>50m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wing Z to Wing Y</td>
<td>70m</td>
<td></td>
</tr>
<tr>
<td>Wing Y to Wing X</td>
<td>125m</td>
<td></td>
</tr>
<tr>
<td>Wing Y to Wing U</td>
<td>80m</td>
<td></td>
</tr>
<tr>
<td>Wing X to Wing U</td>
<td>175m</td>
<td></td>
</tr>
<tr>
<td>Wing Z to Wing U</td>
<td>90m</td>
<td></td>
</tr>
</tbody>
</table>
Number of Computers

<table>
<thead>
<tr>
<th>Wing</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wing X</td>
<td>50</td>
</tr>
<tr>
<td>Wing Z</td>
<td>30</td>
</tr>
<tr>
<td>Wing Y</td>
<td>150</td>
</tr>
<tr>
<td>Wing U</td>
<td>15</td>
</tr>
</tbody>
</table>

(i) Suggest a most suitable cable layout of connections between the Wings, and topology.

(ii) Suggest the most suitable place (i.e. Wing) to house the server of this organisation with a suitable reason, with justification.

(iii) Suggest the placement of the following devices with justification:

1. Repeater
2. Hub/Switch

(iv) The organization is planning to link its head office situated in Delhi with the offices at Srinagar. Suggest an economic way to connect it; the company is ready to compromise on the speed of connectivity. Justify your answer.

(e) Define Firewall. Give its utility.