COMPUTER SCIENCE

Time allowed : 3 hours ]  [ Maximum marks: 70

Instructions:  (1) All questions are compulsory.
               (2) Programming Language : C++

1.  (a) Differentiate between a Run Time Error and Syntax Error. Also give suitable examples of each in C++.
    2

   (b) Name the header file(s) that shall be needed for successful compilation of the following C++ code
    1
    
    ```cpp
    void main ()
    {
        char String [20];
        gets (String);
        strcat (String, “CBSE”);
        puts (String);
    }
    ```

   (c) Rewrite the following program after removing the syntactical error(s) if any. Underline each correction.
    2
    
    ```cpp
    # include <iostream.h>
    ```
const int Max 10;
void main ( )
{
    int Numbers [Max];
    Numbers = { 20, 50,10, 30,40 } ;
    for (Loc= Max-1 ; Loc > = 0 ; Loc --)
        cout>>&Numbers [Loc];
}

(d) Find the output of the following program :

#include < iostream.h>
void main ()
{
    intArray[] = {4,6,10,12};
    int *pointer = Array ;
    for (int I=1 ; I<=3 ; I++)
    {
        cout<<*pointer<<"#";
        pointer ++;
    }
    cout<<endl;
    for (I=1 ; I<=4 ; I++)
    {
        (*pointer)*=3 ;
        -- pointer;
    }
    for(I=1; I<5; I + + )
        cout << Array [I-1] << "@
        cout << endl;
}

(e) Find the output of the following program :

#include < iostream.h>
void Withdef (int HisNum = 30)
{
    for (int 1=20 ; I<=*HisNum; I+=5)
        cout<<I<<""
        cout<<endl;
}
void Control (int &MyNum)
{
    MyNum+=10;
    Withdef(MyNum);
}
void main ()
{
    int YourNum=20;
    Control (YourNum);
    Withdef();
    cout<<"Number="<<YourNum<<endl;
}

(f) In the following C++ program what is the expected value of MyMarks from Options (i) to (iv) given below. Justify answer.

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

void main ()
{
    randomize ();
    int Marks [ ]= {99, 92, 94, 96, 93, 95}, MyMarks;
    MyMarks = Marks [1 + random (2) ];
    cout<<MyMarks<<endl;
}
```

(i) 99  
(ii) 94  
(iii) 96  
(iv) None of the above

2. (a) Differentiate between Constructor and Destructor function in context of Classes and Objects using C++  

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

```cpp
class Maths
{
    char Chapter [20];
    int Marks;
    public:
        Maths ( ) //Member Function 1
```
```cpp
{
    strcpy (Chapter, “Geometry”);
    Marks = 10;
    cout<<“Chapter Initialised”;
{
    ~Math ( )   //Member Function 2
}
    cout<<“Chapter Over”; 
}

(i) Name the specific features of class shown by Member Function 1 and
    Member Function 2 in the above example.
(ii) How would Member Function 1 and Member Function 2 get executed?

(c) Define a class Tour in C++ with the description given below:

Private Members:
  TCode of type string
  NoofAdults of type integer
  NoofKids of type integer
  Kilometres of type integer
  TotalFare of type float

Public Members:
  • A constructor to assign initial values as follows:
    TCode with the word “NULL”
    NoofAdults as 0
    NoofKids as 0
    Kilometres as 0
    TotalFare as 0
  • A function AssignFare () which calculates and assigns the value of
    the data member TotalFare as follows

For each Adult

<table>
<thead>
<tr>
<th>Fare(Rs)</th>
<th>For Kilometres</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>&gt;=1000</td>
</tr>
<tr>
<td>300</td>
<td>&lt;1000 &amp;&gt;=500</td>
</tr>
<tr>
<td>200</td>
<td>&lt;500</td>
</tr>
</tbody>
</table>

For each Kid the above Fare will be 50% of the Fare mentioned in
the above table
```
For example:
If Kilometres is 850, NoofAdults = 2 and NoofKids = 3
Then TotalFare should be calculated as
\[ \text{NumofAdults} \times 300 + \text{NoofKids} \times 150 \]
i.e. \(2 \times 300 + 3 \times 150 = 1050\)

- A function EnterTour( ) to input the values of the data members TCode, NoofAdults, NoofKids and Kilometres; and invoke the Assign Fare( ) function.
- A function ShowTour( ) which displays the content of all the data members for a Tour.

Answer the questions (i) to (iv) based on the following code:
```cpp
class Trainer
{
    char TNo [5], TName [20], Specialisation [10];
    int Days;
protected :
    float Remuneration;
    void AssignRem (float);
public :
    Trainer ( );
    void TEntry ( );
    void TDisplay ( );
};
class Learner
{
    char Regno [10], LName [20], Program [10];
Protected :
    int Attendance, Grade;
public:
    Learner ( );
    void LEntry ( );
    void LDisplay ( );
};
class Institute : public Learner, public Trainer
{
char ICode[10], IName[20];
public:
    Institute();
    void IEntry();
    void IDisplay();
};

(i) Which type of Inheritance is depicted by the above example?

(ii) Identify the member function(s) that cannot be called directly from the objects of class Institute from the following
    TEntry()
    LDisplay()
    IEntry()

(iii) Write name of all the member(s) accessible from member functions of class Institute.

(iv) If class Institute was derived privately from class Learner and privately from class Trainer, then, name the member function(s) that could be accessed through Objects of class Institute.

3. (a) Write a function in C++ which accepts an integer array and its size as arguments and replaces elements having odd values with thrice its value and elements having even values with twice its value.

Example: if an array of five elements initially contains the elements as
    3, 4, 5, 16, 9

then the function should rearrange the content of the array as
    9, 8, 15, 32, 27

(b) An array Array[20][15] is stored in the memory along the column with each element occupying 8 bytes. Find out the Base Address and address of the element Array[2][3] if the element Array[4][5] is stored at the address 1000.

(c) Write a function in C++ to delete a node containing Book’s information, from a dynamically allocated Stack of Books implemented with the help of the following structure.

```c
struct Book
{
    int BNo;
    char BName[20];
    Book *Next;
};
```
(d) Write a function in C++ which accepts a 2D array of integers and its size as arguments and displays the elements which lie on diagonals.

[Assuming the 2D Array to be a square matrix with odd dimension i.e. 3x3, 5x5, 7x7 etc.]

Example, if the array content is

5 4 3
6 7 8
1 2 9

Output through the function should be:

Diagonal One : 5 7 9
Diagonal Two : 3 7 1

(e) Evaluate the following postfix notation of expression:

25 8 3 - / 6 * 10 +

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

```cpp
class PracFile
{
    int Pracno;
    char PracName[20];
    int TimeTaken;
    int Marks;
public:
    // function to enter PracFile details
    void EnterPrac( ) ;
    // function to display PracFile details
    void ShowPrac( ) :
    // function to return TimeTaken
    int RTime() {return TimeTaken;}  
    // function to assign Marks
    void Assignmarks (int M)
    {   Marks = M; }
};
void AllocateMarks( )
{
    fstream File;
```
File.open("MARKS.DAT", ios::binary|ios::in|ios::out);
PracFile P;
int Record = 0;
while (File.read((char*) &P, sizeof(P)))
{
    if(P.RTime()>50)
        P.Assignmarks(0)
    else
        P.Assignmarks(10)
    _______________ //statement 1
    _______________ //statement 2
    Record ++ ;
}
File.close();

If the function AllocateMarks () is supposed to Allocate Marks for the records in the file MARKS.DAT based on their value of the member TimeTaken. Write C++ statements for the statement 1 and statement 2, where, statement 1 is required to position the file write pointer to an appropriate place in the file and statement 2 is to perform the write operation with the modified record.

(b) Write a function in C++ to print the count of the word is as an independent word in at text file DIALOGUE.TXT.

For example, if the content of the file DIALOGUE.TXT is

    This is his book. Is this book good?

Then the output of the program should be 2.

(c) Given a binary file GAME.DAT, containing records of the following structure type

```c
struct Game
{
    char GameName [20];
    char Participant [10][30];
};
```

Write a function in C++ that would read contents from the file GAME.DAT and creates a file named BASKET.DAT copying only those records from GAME.DAT where the game name is “Basket Ball”
5. (a) Differentiate between primary key and alternate key.
(b) Consider the following tables. Write SQL commands for the statements (i) to (iv) and give outputs for SQL queries (v) to (viii)

<table>
<thead>
<tr>
<th>TABLE: SENDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SenderID</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>ND01</td>
</tr>
<tr>
<td>MU02</td>
</tr>
<tr>
<td>MU15</td>
</tr>
<tr>
<td>ND50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE: RECIPIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RecID</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>KO05</td>
</tr>
<tr>
<td>ND08</td>
</tr>
<tr>
<td>MU19</td>
</tr>
<tr>
<td>MU32</td>
</tr>
<tr>
<td>ND48</td>
</tr>
</tbody>
</table>

(i) To display the names of all Senders from Mumbai
(ii) To display the RecID, SenderName, SenderAddress, RecName, RecAddress for every Recipient
(iii) To display Recipient details in ascending order of RecName
(iv) To display number of Recipients from each city
(v) SELECT DISTINCT SenderCity FROM Sender;
(vi) SELECT A. SenderName, B.RecName
    FROM Sender A, Recipient B
    WHERE A. SenderID = B.SenderID AND B.RecCity = ‘Mumbai’;
(vii) SELECT RecName, RecAddress
      FROM Recipient
      WHERE RecCity NOT IN (‘Mumbai’, ‘Kolkata’);
(viii) SELECT RecID, RecName
     FROM Recipient
     WHERE SenderID=’MU02’ ORSenderID=’ND50’;
6. (a) State Distributive law and verify the same using truth table. 
(b) Write the equivalent Canonical Sum of Product expression for the following Product of Sum Expression

\[ F(X,Y,Z) = \pi (1,3,6,7) \]
(c) Write the equivalent Boolean Expression for the following Logic Circuit.

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

\[ F(U,V,W,Z) = \Sigma (0, 1, 2, 3, 4, 10, 11) \]

7. (a) What is the significance of Cyber law?
(b) Expand the following terms with respect to Networking:
   (i) CDMA   (ii) FTP
   (iii) WLL   (iv) HTML
(c) Which of the following unit measures the speed with which data can be transmitted from one node to another node of a network? Also, give the expansion of the suggested unit.
   (i) Mbps
   (ii) KMph
   (iii) MGps
(d) “Bhartiya Connectivity Association” is planning to spread their offices in four major cities in India to provide regional IT infrastructure support in the field of Education & Culture. The company has planned to setup their head office in New Delhi in three locations and have named their New Delhi offices as “Front Office”, “Back Office” and “Work Office”. The company has three more regional offices as “South Office”, “East Office” and “West Office” located in other three major cities of India. A rough layout of the same is as follows:
Approximate distances between these offices as per network survey team is as follows:

<table>
<thead>
<tr>
<th>Place From</th>
<th>Place To</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back Office</td>
<td>Front Office</td>
<td>10KM</td>
</tr>
<tr>
<td>Back Office</td>
<td>Work Office</td>
<td>70 Meter</td>
</tr>
<tr>
<td>Back Office</td>
<td>East Office</td>
<td>1291 KM</td>
</tr>
<tr>
<td>Back Office</td>
<td>West Office</td>
<td>790 KM</td>
</tr>
<tr>
<td>Back Office</td>
<td>South Office</td>
<td>1952 KM</td>
</tr>
</tbody>
</table>

In continuation of the above, the company experts have planned to install the following number of computers in each of their offices:

<table>
<thead>
<tr>
<th>Office</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back Office</td>
<td>100</td>
</tr>
<tr>
<td>Front Office</td>
<td>20</td>
</tr>
<tr>
<td>Work Office</td>
<td>50</td>
</tr>
<tr>
<td>East Office</td>
<td>50</td>
</tr>
<tr>
<td>West Office</td>
<td>50</td>
</tr>
<tr>
<td>South Office</td>
<td>50</td>
</tr>
</tbody>
</table>
(i) Suggest network type (out of LAN, MAN, WAN) for connecting each of the following set of their offices:
   • Back Office and Work Office
   • Back Office and South Office

(ii) Which device you will suggest to be procured by the company for connecting all the computers within each of their offices out of the following devices?
   • Switch/Hub
   • Modem
   • Telephone

(iii) Which of the following communication medium, you will suggest to be procured by the company for connecting their local offices in New Delhi for very effective and fast communication?
   • Telephone Cable
   • Optical Fiber
   • Ethernet Cable

(iv) Suggest a cable/wiring layout for connecting the company’s local offices located in New Delhi. Also, suggest an effective method/technology for connecting the company’s regional offices—“East Office”, “West Office” and “South Office” with offices located in New Delhi.