Roll No. ☐☐☐☐☐☐☐☐

Candidates must write the Code on the title page of the answer-book.

- Please check that this question paper contains **27** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **7** questions.
- Please write down the Serial Number of the question in the answer-book before attempting it.
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

COMPUTER SCIENCE (OLD)

Time allowed : 3 hours   *Maximum Marks : 70*

General Instructions :

(i)   *SECTION A refers to programming language C++.*

(ii)   *SECTION B refers to programming language Python.*

(iii)   *SECTION C is compulsory for all.*

(iv)   *Answer either SECTION A or SECTION B.*

(v)   *It is compulsory to mention on page 1 in the answer-book whether you are attempting SECTION A or SECTION B.*

(vi)   ***All*** *questions are compulsory within each section.*

(vii)   *Questions 2(b), 2(d), 3 and 4 have internal choices.*

SECTION A
[Only for candidates, who opted for C++]

1. (a) Identify the valid keywords in C++ from the following : *2*

    (i)   `If`

    (ii)   `for`

    (iii)   `case`

    (iv)   `Object`

    (v)   `struct`

    (vi)   `sub`

    (vii)   `float`

    (viii) `My_class`

(b) Write the names of the correct header files, which must be included in the following C++ code to compile the code successfully : *1*

```
void main()
{
   int X = random(10);
   int Y = random(20);
   cout<<"sum of "<<X<<" and "<<Y<<" = "<<X+Y<<endl;
}
```

(c) Rewrite the following C++ program after removing any/all syntactical errors with each correction underlined : *2*
Note : Assume all required header files are already included in the program.

```
void main()
{
   cout<<"Enter two integers";
   cin>>A>>B;
   if A <= B
     A += B;
     B -= 5;
   else
   {
     B = B + A;
     A - 5 = A;
   }
   cout<<A<<" : "<< B << Endl;
}
```

(d) Find and write the output of the following C++ program code :   *2*
Note : Assume all required header files are already included in the program.

```cpp
void ChangeVal(int *M, int N)
{
    for(int i=0;i<N ; i++)
    {
        if (*M%5 == 0)
            *M /= 5;
        if (*M%3 == 0)
            *M /= 3;
        M++;
    }
}
void main()
{
    int Val[]={25,8,75,12};
    ChangeVal(Val,4);
    for(int i=0;i<4; i++)
        cout<<Val[i]<<"*";
    cout<<endl;
}
```

(e) Find and write the output of the following C++ program code :   *3*
Note : Assume all required header files are already included in the program.

```cpp
struct Product
{
    int X, Y;
};
void Change(Product &P)
{
    P.X += 5; P.Y -= 5;
}
void Multiply(int P1, int P2)
{
    cout<<"First = "<<P1<<" & Second = "<<P2<<endl;
    cout<<"Product = "<<P1*P2<<endl;
}
void main()
{
    Product P[] = {{7,10},{10,7},{7,7}};
    for(int i=0; i<3; i++)
    {
        Change(P[i]);
        Multiply(P[i].X, P[i].Y);
    }
}
```

(f) Look at the following C++ code and find the possible output(s) from the options (i) to (iv) following it. Also, write the minimum and maximum values that can possibly be assigned to the variable **End**. *2*

Note :

- Assume all the required header files are already being included in the code.

```cpp
void main()
{
  randomize();
  char Colours[][20] = {"VIOLET","INDIGO","BLUE","GREEN",
                        "YELLOW","ORANGE","RED"};
  int End = random(2)+3;
  int Begin = random(End)+1;
  for(int i= Begin; i<End; i++)
    cout<<Colours[i]<<"&";
}
```

(i) **INDIGO&BLUE&GREEN&**	(ii) **VIOLET&INDIGO&BLUE&**
(iii) **BLUE&GREEN&YELLOW&**	(iv) **GREEN&YELLOW&ORANGE&**

2. (a) Explain Single level inheritance in context of Object Oriented Programming in C++. Also, write a suitable example in C++ to illustrate Single level inheritance. *2*

(b) Observe the following C++ code and answer the questions (i), (ii), (iii) and (iv) : *2*

Note : Assume all necessary files are included.

```cpp
class Triangle
{
    int S1,S2,S3;
public:
    Triangle(int X=0, int Y=0, int Z=0)    //Function 1
    {
        S1=X; S2=Y; S3=Z;
    }
    Triangle(Triangle &T)                  //Function 2
    {
        T.S1 += 15;
        S1 = T.S1;
        S2 = T.S2;
        T.S2 += 20;
        S3 = T.S3;
    }
    void Show()                            //Function 3
    {
        cout<<S1<<"#"<<S2<<"#"<<S3<<endl;
    }
};

void main()
{
    _____       //Statement 1
    _____       //Statement 2
    _____       //Statement 3
}
```

(i) Write Statement 1 to declare an object T1 of class Triangle, initialised by values 10 for S1, 20 for S2 and and 0 for S3.

(ii) Write Statement 2 which would invoke Function 2.

(iii) Write Statement 3 which would invoke Function 3 for the object T1 declared in Statement 1.

(iv) Write the output of the above code after execution of all the three statements, Statement 1, Statement 2 and Statement 3 in the main().

OR

Write any two differences between a constructor and a destructor function declared inside a class. Illustrate with the help of a suitable example. *2*

(c) Write the definition of a class CARGO in C++ with the following description : *4*

Private Members

- `Distance`   `// integer`
- `Weight`   `// integer`
- `Charge`   `// float`
- `GetCharge()`

    `Member function to assign value of Charge based upon Distance and Weight as follows :`

Distance(Km)	Weight(Grams)	Charge(₹)
<=100	<=500	150
>100 and <=500	>500 and <=999	300

Public Members

- `Enter()`

    `/* The function should allow a user to enter values of Distance and Weight to assign the value of Charge. It must then invoke the GetCharge() to assign value of Charge */`

- `Display() // Function to display all the data members`

(d)   Answer the questions (i) to (iv) based on the following :   *4*

```
class Book
{
    char Bno[20];
protected:
    float Price;
public:
    void GetB();
    void ShowB();
};

class Member
{
    char Mno[20];
protected:
    char Name[20];
public:
    void GetM();
    void ShowM();
};

class Library : public Member, private Book
{
    char Lname[20];
public:
    void GetL();
    void ShowL();
};

void main()
{
    Library L;
}
```

(i)   Which type of Inheritance out of the following is illustrated
        in the above example ?

        –   **Single Level Inheritance, Multilevel Inheritance,
            Multiple Inheritance**

(ii)   Write the names of **all the data members**, which are
        directly accessible by the member function **GetL()** of class
        Library.

(iii) Write the names of **all the member functions**, which are directly accessible by the member function **ShowL()** of class **Library**.

(iv) Write the names of **all the members**, which are directly accessible by the object **L** of class **Library** declared in the **main()** function.

OR

Consider the following class College, assuming all required header files being included :

```
class College
{
    char Cname[20];
protected :
    float Fees;
public:
    void ShowCollege();
};
```

Write a code in C++ to privately derive another class Faculty from the base class College with the following members : *4*

Data Members

* Total_seats of type int
* FName of type char array of size 20

Member Functions

* A constructor function to assign Total_seats as 500.
* GetFac() to allow user to enter FName and assign Fees (of the base class College) its value depending upon entered FName as follows :

FName	Fees
Science	35000
Commerce	25000

* ShowFac() to display all the data members which are accessible to it.

3. (a) Write the definition of a function `Mean(int A[], int N)` in C++, which should display the Mean (Average) of all the N number of integers in the array `A`. *2*

Example : If the array `A` contains following 5 elements (i.e. for `N=5`)

0	1	2	3	4
25	5	15	10	25

Then the function should display the output as follows :

```
Mean = 16
```

OR

Write the definition of a function `ChangeConsonant(char Str[])` in C++, which should replace every occurrence of a consonant (non vowel letters) with its previous letter (example, replace letter 'b' to 'a' and 'B' to 'A', 'c' to 'b' and 'C' to 'B', 'd' to 'c' and 'D' to 'C', 'f' to 'e' and 'F' to 'E' and so on...). The function should finally display the charged content of the string. *2*

Example : If the array `Str` contains the string : "Elephant"

Then the function should rearrange the string to "Ekeogams"

(b) Write the definition for a function `SumAlter(int Arr[10][10], int N)` in C++, for a square matrix `Arr` having `N` rows and `N` columns, which displays the sum of the elements of alternate rows starting from the second row and the sum of the elements of the alternate columns starting from the second column respectively. *3*

For example : If array `Arr` for `N=4`, contains the following elements :

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Then the function should display the following output :

```
Sum of alternate rows = 84
Sum of alternate columns = 72
```

OR

Write the definition for a function **RevAlternate(char S[][20], int N)** in C++, which reverses the contents of the strings at every odd index of the array of strings S. *3*

For example : For an array **S** containing 6 strings (for **N=6**) as follows:

ORIGINAL ARRAY S	CHANGED ARRAY S
First	First
Second	dnoceS
Third	Third
Fourth	htruoF
Fifth	Fifth
Sixth	htxiS

Note :

- **DO NOT DISPLAY** the Changed Array contents.
- Do not use any other array to transfer the contents of the array S.

(c)   Let us assume Q[20][15] is a two-dimensional array, which is stored in the memory along the row and each of its element occupies 4 bytes. Find the address of the element Q[15][5], if the address of the element Q[5][10] is 25000. *3*

OR

Let us assume N[30][25] is a two-dimensional array, which is stored in the memory along the column and each of its elements occupies 4 bytes. Find the address of the element N[5][10], if the base address of the array is 20000. *3*

(d)   Write the definition of a function **Push(int P[], int &T)**, which pushes an integer and **Pop(int P[], int &T)** which pops an integer from the static stack of integers **P**, where the top of the stack is represented by index **T**. The stack should be able to store a maximum of 10 integers. The functions must also check for stack overflow and stack underflow errors. *4*

OR

For the following structure of Book in C++

```
struct Book
{
    int    Bno;
    Book  *Link;
};
```

Given that the following declaration of class BookStack in C++ represents a dynamic stack of Buses :

```
class BookStack
{
    Book *Top;       //Pointer T to store address of the
                     //topmost Node of type Book
public:
    BookStack()
    {
      Top = NULL;
    }
    void Push(); //Function to push a Book Node into the
                     //dynamic stack
    void Pop();     //Function to pop a Book Node from the
                     //dynamic stack
    ~BookStack();
};
```

Write the definition for the member function **void BookStack::Pop(),** that pops a Book Node from the dynamic stack of BookStack. The function must also check for an underflow error. *4*

(e)   Evaluate the following Postfix expression, showing the stack contents : *2*

       `180,15,6,*,30,+,60,-,/`

OR

Convert the following Infix expression to its equivalent Postfix expression, showing the stack contents for each step of conversion : *2*

       `P * Q / R - S ^ T`

4. (a) A text file named **SOLUTION.TXT** contains some English sentences. Another text file named **TEST.TXT** needs to be created such that it replaces every occurrence of 3 consecutive letters 'h', 'i' and 's' (irrespective of their cases) from each word of the file **SOLUTION.TXT**, with 3 underscores ('__').

For example : If the file **SOLUTION.TXT** contains the following content :

"This is his history book."

Then **TEST.TXT** should contain the following :

"T____ is ____ ____tory book."

Write the definition for function **CreateTest()** in C++ that would perform the above task of creating **TEST.TXT** from the already existing file **SOLUTION.TXT**. *3*

<div align="center">

OR

</div>

A text file named **AGENCIES.TXT** contains some text. Write the definition for a function **Showsites()** in C++ which displays all such words of the file which have more than 9 characters and start with **"www."**. For example : if the file **AGENCIES.TXT** contains : *3*

"Name: TechnoCraft,   Website: www.technocraft.com,
Name: DataTech, Website: www.datatech.com"

Then the function **Showsites()** should display the output as :
www.technocraft.com
www.datatech.com

(b) Write a definition for function **Billing()** in C++ to read each record of a binary file **STOCK.DAT**, and display the Total Price of all the records in the file. Assume that the file **STOCK.DAT** is created with the help of objects of class Stock, which is defined below : *2*

```
class Stock
{
    char Name[20]; float Price;
public:
    float RPrice() { return Price; }
};
```

<div align="center">

OR

</div>

A binary file **ELECTION.DAT** contains records stored as objects of the following class :

```
class ELECTION
{
    char Name[20]; int Count;
public:
    int GetCount() { return Count; }
    Char *RName() { return Name; }
};
```

Write the definition for function **LowCount()** in C++, which reads every record from the file **ELECTION.DAT** and displays every such **Name** whose **Count** is less than 100. *2*

(c) Considering that binary file **TRAINS.DAT** contains 100 records of the following class Train, find the output of the following C++ code : *1*

```
class Train
{
    int Tno; char FROM[20], To[20];
public:
    void Get(); void Show();

};

void main()
{   fstream File;
    File.open("TRAINS.DAT",ios::binary|ios::in);
    Train T;
    File.read((char*)&T,sizeof(T));
    File.seekg(25*sizeof(T));
    cout<<"Presently at "<< File.tellg()/sizeof(T)<< endl;
    File.read((char*)&T,sizeof(T));
    cout<<"Now at "<< File.tellg()/sizeof(T)<< endl;
    File.close();
}
```

OR

Differentiate between seekg() and tellg(). *1*

SECTION B

[Only for candidates, who opted for Python]

1. (a) Identify the valid keywords in Python from the following :   *2*

    (i)   `Queue`

    (ii)   `False`

    (iii)   `in`

    (iv)   `Number`

    (v)   `global`

    (vi)   `method`

    (vii)   `import`

    (viii)   `List`

(b) Name the Python Library modules which need to be imported to invoke the following functions :   *1*

    (i)   `floor()`

    (ii)   `random()`

(c) Rewrite the following code in Python after removing all syntax error(s). Underline each correction done in the code.   *2*

```
W = raw_input('Enter a word')
If W <> 'HELLO':
    print W + 2
else
    print W * 2
```

(d) Find and write the output of the following Python code :   *2*

```
def ChangeVal(M,N):
  for i in range(N):
   if M[i]%5 == 0:
      M[i] //= 5
   if M[i]%3 == 0:
      M[i] //= 3
Val=[25,8,75,12]
ChangeVal(Val,4)
for N in Val:
   print N,'#',
```

(e) Find and write the output of the following Python code : *3*

```
def Assign(P=30,Q=40):
    P=P+Q
    Q=P-Q
    print P,'@',Q
    return P
A=100
B=150
A=Assign(A,B)
print A,'@',B
B=Assign(B)
print A,'@',B
```

(f) What possible output(s) are expected to be displayed on screen at the time of execution of the program from the following code ? Also, specify the minimum and maximum values that can be assigned to the variable End. *2*

```
import random

Rainbow = ["VIOLET","INDIGO","BLUE","GREEN",
           "YELLOW","ORANGE","RED"]

End = randrange(2)+3
Begin = randrange(End)+1
for i in range (Begin,End):
    print Rainbow[i],"&",
```

(i) `INDIGO & BLUE & GREEN &`	(ii) `VIOLET & INDIGO & BLUE &`
(iii) `BLUE & GREEN & YELLOW &`	(iv) `GREEN & YELLOW & ORANGE &`

2. (a) What is method/function overriding in Python. Write a Python code to illustrate how to invoke a base class overridden method inside an inherited class. *2*

(b)   Write the output of the given Python code :   *2*

```python
class Volume(object):
    Length=10
    Breadth=20
    Height=5
    def __init__(self,X=20, Y=30, Z=10):
        self.Length = X
        self.Breadth = Y
        self.Height = Z
    def ShowVol(self):
        print self.Length*self.Breadth*self.Height
        print Volume.Length*Volume.Breadth*Volume.Height
V1=Volume(15,30,10)
V1.ShowVol()
Volume.Height = 20
V2=Volume(30,40)
V2.ShowVol()
```

OR

```python
class Triangle(object):
    def __init__(self,N1=3, N2=4, N3=5): # Function 1
        self.Side1 = N1
        self.Side2 = N2
        self.Side3 = N3
    def ShowSides(self):                 # Function 2
        print self.Side1, self.Side2, self.Side3
    def __del__(self):                   # Function 3
        print "Nothing to show"
def Workit():                            # Function 4
    _____                           # Statement 1
    _____                           # Statement 2
Workit()
```

(i)   Write the missing Statement 1 which will invoke the Function
       1 for an object **T** of the class Triangle with values for Side1 as
       10, Side2 as 15 and Side3 as 20, and the missing Statement 2
       which will invoke the Function 2 for the object **T**.

(ii)   Write the output for the above Python code after the missing
       Statement 1 and Statement 2 are correctly written.   *2*

(c) Write the definition of a class CARGO in Python with following description : *4*

Instance Attributes

- **Distance**

- **Weight**

- **Charge**

Methods/Functions

- **GetCharge()**

  # to assign value of Charge based upon Distance and

  # Weight as follows :

Distance(Km)	Weight(Grams)	Charge(₹)
<=100	<=500	150
>100 and <=500	>500 and <=999	300

- **Enter()**   **# The function should allow a user to**

  # enter values of Distance and Weight

  # to assign the value of Charge

  # It must then call the GetCharge()to

  # assign value of Charge

- **Display()**   **# Function to display Distance, Weight**

  # and Charge

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

```
class Book(object):
    def __init__(self,B_No,B_Price):
        self.Bno = B_No
        self.Price = B_Price
    def GetB(self,B_No,B_Price):
        self.Bno = B_No
        self.Price = B_Price
    def ShowB(self):
        print self.Bno, self.Price,

class Member(object):
    def __init__(self,M_Num,M_Name):
        self.Mno=M_Num
        self.Mname=M_Name
    def GetM(self,M_Num,M_Name):
        self.Mno=M_Num
        self.Mname=M_Name
    def ShowM(self):
        print self.Mno, self.MName

class Library(Book,Member):
    def __init__(self,L_Name,B,P,M,N):        #Function 1
        self.Lname=L_Name
        Book.__init__(self,B,P)
        Member.__init__(self,M,N)
    def GetL(self,L_Name,B,P,M,N):            #Function 2
        self.Lname=L_Name
        Book.GetB(self,B,P)
        Member.GetM(self,M,N)
    def ShowL(self):
        Print self.Lname
        Book.ShowB(self)
        Member.ShowM(self)

    L=Library('First',101,150,901,'Roshni')
    L.ShowL()
    L.GetL('Second',102,200,902,'Simran')
    L.ShowL()
```

(i) Write the type of the inheritance illustrated in the above Python code. *1*

(ii) Write the output of the above code. *2*

(iii) What is the difference between Function 1 and Function 2, although their definitions are the same. *1*

OR

Consider the following class Shape in Python :

```python
class Company(object):
    CName=""
    Area=0
    def __init__(self,N):
        Company.CName=N
        Company.Area=20
    def ShowCompany(self):
        print self.CName,self.Area
```

Write a code in Python derive another class Department from the class Company with the following :

- Attribute DName initialised with an empty string

- Attribute DArea initialised with 0

Class methods/functions

- A constructor function which should first invoke the class Company's constructor passing Company name (for CName) as parameter.

- GetDept() to allow user to enter DName and DArea and then add the entered value of DArea (of the class Department) to the attribute Area (of the class Company).

- ShowDept() which should display the CName, Area of class Company followed by DName and DArea of class Department. *4*

3. (a) Consider the following randomly ordered numbers stored in a list :

        `325, 215, 74, 465, 520, 132, 97`

Show the content of list after the First, Third and Fourth pass of the Bubble sort method used for arranging in **ascending order**.   *3*

Note : Show the status of all the elements after each pass very clearly encircling the changes.

OR

Consider the following randomly ordered numbers stored in a list :

        `325, 215, 74, 465, 520, 132, 97`

Show the content of the list after the Second, Third and Fourth pass of the Insertion sort method used for arranging in **descending order**.   *3*

Note : Show the status of all the elements after each pass very clearly encircling the changes.

(b) Write the definition of a function **AddPrev(A, N)** in Python, which should add every previous value of list **A** to the next value and assign the sum at the index of the next value. The list **A** contains **N** number of integers. The function should finally display the entire content of the changed list.   *3*

Example : If the list **A** contains the following 10 elements (i.e. for **N=10**).

0	1	2	3	4	5	6	7	8	9
9	5	15	10	25	12	5	9	5	12

Then the function should display the output as follows :

    9 # 14 # 29 # 39 # 64 # 76 # 81 # 90 # 95 # 107 #

OR

Write the definition of a function **ChangeEvenOdd(Num, N)** in Python, which should add 1 to every even number and subtract 1 from every odd number. The function should finally display the changed content of the list Num.   *3*

Example : If the list **Num** contains the following 10 elements (i.e. for **N=10**)

0	1	2	3	4	5	6	7	8	9
25	12	5	10	9	5	15	9	5	12

Then the function should display the output as follows :

    `24 13 4 11 8 4 14 8 4 13`

(c) Write functions in Python for **PushS(List)** and for **PopS(List)** for performing Push and Pop operations with a stack of List containing integers. The function must check for Empty Stack. *4*

<div align="center">**OR**</div>

Write functions in Python for **InsertQ(Names)** and **RemoveQ(Names)** for performing insertion and removal operations with a queue of list which contains names of students. The function must check for Empty Queue. *4*

(d) Write a Python method/function **SwapParts(Word)** to swap the first part and the second part of the string Word. Assuming there are an even number of letters in the string Word. The function should finally display the changed Word. *2*

For example : If **Word = 'Elephant'** then the function should convert Word to **'hantElep'** and display the output as:

Changed Word is hantElep

<div align="center">**OR**</div>

Write a Python method/function **Noun2Adj(Word)** which checks if the string Word ends with the letter 'y'. If so, it replaces the last letter 'y' with the string 'iful' and then displays the changed Word. For example if the Word is **"Beauty"**, then the Word should be changed to **"Beautiful"**. *2*

Otherwise it should display

Not ending with "y"

(e) Evaluate the following Postfix expression, showing the stack contents : *2*

        180,15,6,*,30,+,60,-,/

<div align="center">**OR**</div>

Convert the following Infix expression to its equivalent Postfix expression, showing the stack contents for each step of conversion : *2*

        P * Q / R - S ^ T

4. (a) What is a **NameError** in Python ? *1*

<div align="center">**OR**</div>

What is a **TypeError** in Python ? *1*

(b) A text file named **SOLUTION.TXT** contains some English sentences. Another text file named **TEST.TXT** needs to be created such that it replaces every occurence of 3 consecutive letters 'h', 'i' and 's' (irrespective of their cases) from each word of the file **SOLUTION.TXT**, with 3 underscores ('___').

For example : If the file **SOLUTION.TXT** contains the following content :

"This is his history book."

Then **TEST.TXT** should contain the following :

"T ___ is ___ ___tory book."

Write the definition for function **CreateTest()** in Python that would perform the above task of creating **TEST.TXT** from the already existing file **SOLUTION.TXT**. *3*

OR

A text file named **AGENCIES.TXT** contains some text. Write the definition for a function **Showsites()** in Python which displays all such words of the file which have more than 9 characters and start with **"www."**.

For example : If the file **AGENCIES.TXT** contains :

"Name: TechnoCraft, Website: www.technocraft.com,

Name: DataTech, Website: www.datatech.com" *3*

Then the function **Showsites()** should display the output as :

www.technocraft.com

www.datatech.com

(c) Write a definition for function **Billing()** in Python to read each record of a pickled file **STOCK.DAT**, and display the Total Price of all the records in the file. Assume that the file **STOCK.DAT**, is created with the help of objects of class Stock, which is defined below : *2*

```
class Stock(object):
    def __init__(self,N='',P=0):
        self.SName=N
        self.Price=P
```

OR

A pickled file **ELECTION.DAT** contains records stored as objects of the following class :

```
class Election(object):
    def __init__(self,N,C):
        self.Name=N
        self.Count=C
```

Write the definition for function **LowCount()** in Python, which reads every record from **ELECTION.DAT** and displays every such **Name** whose **Count** is less than 10. *2*

SECTION C

[For all candidates]

5. (a) Observe the following tables EMPLOYEES and DEPARTMENT carefully and answer the questions that follow : *2*

TABLE : EMPLOYEES

ENO	ENAME	DOJ	DNO
E1	NUSRAT	2001-11-21	D3
E2	KABIR	2005-10-25	D1

TABLE : DEPARTMENT

DNO	DNAME
D1	ACCOUNTS
D2	HR
D3	ADMIN

   (i) What is the Degree of the table EMPLOYEES ? What is the cardinality of the table DEPARTMENT ?

   (ii) Write the result of a Cartesian Product operation performed upon the tables EMPLOYEES and DEPARTMENT upon the common attribute DNO from both tables.

   (b) Write SQL queries for (i) to (iv) and write outputs for SQL queries for (v) to (viii), which are based on the following two tables, CUSTOMERS and PURCHASES : *6*

Table : CUSTOMERS

CNO	CNAME	CITIES
C1	SANYAM	DELHI
C2	SHRUTI	DELHI
C3	MEHER	MUMBAI
C4	SAKSHI	CHENNAI
C5	RITESH	INDORE
C6	RAHUL	DELHI
C7	AMEER	CHENNAI
C8	MINAKSHI	BANGALORE
C9	ANSHUL	MUMBAI

Table : PURCHASES

SNO	QTY	PUR_DATE	CNO
S1	15	2018-12-25	C2
S2	10	2018-11-10	C1
S3	12	2018-11-10	C4
S4	7	2019-01-12	C7
S5	11	2019-02-12	C2
S6	10	2018-10-12	C6
S7	5	2019-05-09	C8
S8	20	2019-05-09	C3
S9	8	2018-05-09	C9
S10	15	2018-11-12	C5
S11	6	2018-08-04	C7

(i)   To display details of all CUSTOMERS whose CITIES are neither Delhi nor Mumbai.

(ii)   To display the CNAME and CITIES of all CUSTOMERS in ascending order of their CNAME.

(iii) To display the number of CUSTOMERS along with their respective CITIES in each of the CITIES.

(iv)   To display details of all PURCHASES made (PUR_DATE) in the year 2019.

(v)   `SELECT COUNT(DISTINCT CITIES) FROM CUSTOMERS;`

(vi)   `SELECT MAX(PUR_DATE) FROM PURCHASES WHERE QTY <10;`

(vii) `SELECT CITIES FROM CUSTOMERS`

       `GROUP BY CITIES HAVING COUNT(*) = 2;`

(viii) `SELECT CNAME, QTY, PUR_DATE FROM CUSTOMERS, PURCHASES WHERE CUSTOMERS.CNO = PURCHASES.CNO AND QTY IN (10,20);`

6. (a) State any one of the Absorption Laws of Boolean Algebra and verify it using truth table.   *2*

(b) Draw the Logic Circuit of the following Boolean Expression :   *2*
     `A′ . B + B′ . C′`

(c) Derive a Canonical SOP expression for a Boolean function F, represented by the following truth table :   *1*

X	Y	Z	F(X,Y,Z)
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

(d) Reduce the following Boolean Expression to its simplest form using K-Map : *3*

$$F(A,B,C,D) = \Sigma(5,6,7,10,11,13,14,15)$$

7. (a) A CEO of a car manufacturing company ElectroCars Ltd. located at Mumbai wants to have an annual meeting with his counterparts located at Delhi and Chennai where he would like to show as well as see and discuss the presentations prepared at the three locations for the financial year. Which communication technology out of the following is best suited for taking such an online demonstration ? *1*

(i) Chat

(ii) Teleconferencing

(iii) Video Conferencing

(b) Match the Telecommunication Technologies listed in the first column of the following table with their corresponding features listed in the second column of the table : *2*

Technology	Feature
1G	• IP-based Protocols (LTE) • True Mobile Broadband
2G	• Improved Data Services with Multimedia • Mobile Broadband
3G	• Basic Voice Services • Analog-based Protocol
4G	• Better Voice Services • Basic Data Services • First Digital Standards (GSM, CDMA)

(c) Write the names of one client side and one server side scripting language. *1*

(d) Write the expanded names for the following abbreviated terms used in Networking and Communications : *2*

    (i)   PPP

    (ii)   PAN

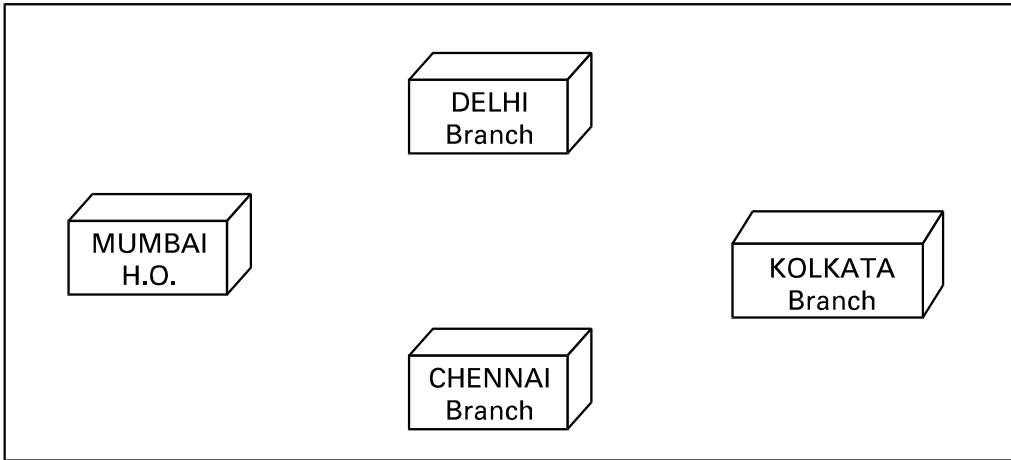   (iii) FTP

    (iv) WLL

(e) Helping Hands is an NGO with its head office at Mumbai and branches located at Delhi, Kolkata and Chennai. Their Head Office located at Delhi needs a communication network to be established between the head office and all the branch offices. The NGO has received grant approval from the Central Government for setting up the network. The physical distances between the branch offices and the head office and the number of computers to be installed in each of these branch offices and the head office are given below. As a network expert you have to suggest the best possible solutions for the queries as raised by the NGO, as given in (i) to (iv).

Distances between various locations in Kilometres :

Mumbai H.O. to Delhi	1420
Mumbai H.O. to Kolkata	1640
Mumbai H.O. to Chennai	2710
Delhi to Kolkata	1430
Delhi to Chennai	1870
Chennai to Kolkata	1750

Number of Computers installed at various locations are as follows :

Mumbai H.O.	2500
Delhi Branch	1200
Kolkata Branch	1300
Chennai Branch	1100

(i) Suggest the drawing the best cable layout for effective network connectivity of all the Branches and the Head Office for communicating data. *1*

(ii) Suggest the most suitable location to install the main server of this NGO to communicate data with all the offices. *1*

(iii) Write the name of the type of network out of the following, which will be formed by connecting all the computer systems across the network : *1*

(A) WAN

(B) MAN

(C) LAN

(D) PAN

(iv) Suggest the most suitable medium for connecting the computers installed across the network out of the following : *1*

(A) Optical fibre

(B) Telephone wires

(C) Radio Waves

(D) Ethernet cable