Roll No. ☐☐☐☐☐☐☐

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

- Please check that this question paper contains **23** 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 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

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 the page 1 in the answer book whether you are attempting SECTION A or SECTION B.

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

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

1. (a) Write the type of C++ tokens (keywords and user defined identifiers) from the following : *2*

 (i) **else**

 (ii) **Long**

 (iii) **4Queue**

 (iv) **_count**

 (b) The following C++ code during compilation reports errors as follows :

 Error: 'ofstream' not declared

 Error: 'strupr' not declared

 Error: 'strcat' not declared

 Error: 'FIN' not declared

 Write the names of the correct header files, which must be included to compile the code successfully : *1*

```
void main()
{
    ofstream FIN("WISH.TXT");
    char TEXT2[]="good day";
    char TEXT1[]="John!";

    strupr(TEXT2);
    strcat(TEXT1, TEXT2);
    FIN<<TEXT1<<endl;
}
```

(c) Rewrite the following C++ code after removing any/all syntactical errors with each correction underlined. *2*

Note : Assume all required header files are already included in the program.

```
Typedef Count int;
void main()
{
   Count C;
   cout<<"Enter the count:";
   cin>>C;
   for (K = 1; K<=C; K++)
      cout<< C "*" K <<endl;
}
```

(d) Find and write the output of the following C++ program code : *3*

Note : Assume all required header files are already included in the program.

```
void Revert(int &Num, int Last=2)
{
   Last=(Last%2==0)?Last+1:Last-1;
   for(int C=1; C<=Last; C++)
      Num+=C;
}
void main()
{
   int A=20,B=4;
   Revert(A,B);
   cout<<A<<"&"<<B<<endl;
   B--;
   Revert(A,B);
   cout<<A<<"#"<<B<<endl;
   Revert(B);
   cout<<A<<"#"<<B<<endl;
}
```

3

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(e) 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
#define Modify(N) N*3+10
void main()
{
    int LIST[]={10,15,12,17};
    int *P=LIST, C;
    for(C=3; C>=0; C--)
       LIST[I]=Modify(LIST[I]);

    for (C=0; C<=3; C++)
    {
        cout<<*P<<":";
        P++;
     }
}
```

(f) Look at the following C++ code and find the possible output(s) from the options (i) to (iv) following it. Also, write the highest and lowest values that can be assigned in the array A. *2*

Note :

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

- The function random(n) generates an integer between 0 and n – 1.

```cpp
void main()
{
  randomize();
  int A[4], C;
  for(C=0; C<4; C++)
     A[C]=random(C+1)+10;
  for(C=3; C>=0; C--)
     cout<<A[C]<<"@";
}
```

(i)	(ii)
13@10@11@10@	15$14$12$10$
(iii)	(iv)
12@11@13@10@	12@11@10@10@

4

2. (a) Which function(s) out of the following can be considered as overloaded function(s) in the same program ? Also, write the reason for not considering the other(s) as overloaded function(s). *2*

```
void Execute(char A,int B);      // Function 1
void Execute(int A,char B);      // Function 2
void Execute(int P=10);          // Function 3
void Execute();                  // Function 4
int Execute(int A);              // Function 5
void Execute(int &K);            // Function 6
```

(b) Observe the following C++ code and answer the questions (i) and (ii).
Note : Assume all necessary files are included.

```
class FIRST
{
    int Num1;
public:
    void Display()                 //Member Function 1
    {
        cout<<Num1<<endl;
    }
};


class SECOND: public FIRST
{
    int Num2;
public:
    void Display()                 //Member Function 2
    {
        cout<<Num2<<endl;
    }
};
void main()
{
    SECOND S;

    _____              //Statement 1
    _____              //Statement 2
}
```

5

(i) Which Object Oriented Programming feature is illustrated by the definitions of classes FIRST and SECOND ? *1*

(ii) Write Statement 1 and Statement 2 to execute Member Function 1 and Member Function 2 respectively using the object S. *1*

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

Private Members

```
- Radius, Height    // float
- Type              // int (1 for Cone,2 for Cylinder)
- Volume            // float
- CalVolume()       // Member function to calculate
                    // volume as per the Type
```

Type	Formula to calculate Volume
1	3.14*Radius*Height
2	3.14*Radius*Height/3

Public Members

```
- GetValues()  // A function to allow user to enter value
               // of Radius, Height and Type. Also, call
               // function CalVolume() from it

- ShowAll()    // A function to display Radius, Height,
               // Type and Volume of Container
```

6

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

```cpp
class Teacher
{
    int TCode;
protected:
    char Name[20];
public:
    Teacher();
    void Enter(); void Show();
};

class Course
{
    int ID;
protected:
    Char Title[30];
public:
    Course();
    void Initiate();
    void Display();
};

class Schedule : public Course, private Teacher
{
    int DD,MM,YYYY;
public:
    Schedule();
    void Start();
    void View();
};
void main()
{
    Schedule S;
}
```

(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 members, which are directly accessible by the member function View() of class Schedule.

(iii) Write the names of all the members, which are directly accessible by the object S of class Schedule declared in the main() function.

(iv) What will be the order of execution of the constructors, when the object S of class Schedule is declared inside the main() function ?

3. (a) Write the definition of a function **SumEO(int VALUES[], int N)** in C++, which should display the sum of even values and sum of odd values of the array separately. *2*

Example : If the array VALUES contains

| 25 | 20 | 22 | 21 | 53 |

Then the functions should display the output as :

Sum of even values = 42 (i.e., 20+22)

Sum of odd values = 99 (i.e., 25+21+53)

(b) Write a definition for a function **UpperHalf(int Mat[4][4])** in C++, which displays the elements in the same way as per the example shown below. *3*

For example, if the content of the array Mat is as follows :

25	24	23	22
20	19	18	17
15	14	13	12
10	9	8	7

The function should display the content in the following format :

```
25    24    23    22

20    19    18

15    14

10
```

(c) Let us assume Data[20][15] is a two-dimensional array, which is stored in the memory along the row with each of its elements occupying 2 bytes. Find the address of the element Data[10][5], if the element Data[15][10] is stored at the memory location 15000. *3*

(d) Write the definition of a member function AddPacket() for a class QUEUE in C++, to remove/delete a Packet from a dynamically allocated QUEUE of Packets considering the following code is already written as a part of the program. *4*

```
struct Packet
{
    int     PID;
    char    Address[20];
    Packet  *LINK;
};

class QUEUE
{
    Packet *Front, *Rear;
public:
    QUEUE(){Front=NULL;Rear=NULL;}
    void AddPacket();
    void DeletePacket();
    ~QUEUE();
};
```

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

```
U * V + (W – Z) / X
```

4. (a) A text file named **MATTER.TXT** contains some text, which needs to be displayed such that every next character is separated by a symbol '#'.

Write a function definition for **HashDisplay()** in C++ that would display the entire content of the file **MATTER.TXT** in the desired format. *3*

Example :
If the file MATTER.TXT has the following content stored in it :
THE WORLD IS ROUND

The function **HashDisplay()** should display the following content :
T#H#E# #W#O#R#L#D# #I#S# #R#O#U#N#D#

(b) Write a definition for a function TotalTeachers( ) in C++ to read each object of a binary file SCHOOLS.DAT, find the total number of teachers, whose data is stored in the file and display the same. Assume that the file SCHOOLS.DAT is created with the help of objects of class SCHOOLS, which is defined below : *2*

```cpp
class SCHOOLS
{
    int SCode;        //School Code
    char SName[20];   //School Name
    int NOT;          //Number of Teachers in the school

public:
    void Display()
    {cout<<SCode<<"#"<<SName<<"#"<<NOT<<endl;}
    int RNOT(){return NOT;}
};
```

(c) Find the output of the following C++ code considering that the binary file SCHOOLS.DAT exists on the hard disk with the following records of 10 schools of the class SCHOOLS as declared in the previous question (4 b). *1*

SCode	SName	NOT
1001	Brains School	100
1003	Child Life School	115
1002	Care Share School	300
1006	Educate for Life School	50
1005	Guru Shishya Sadan	195
1004	Holy Education School	140
1010	Play School	95
1008	Innovate Excel School	300
1011	Premier Education School	200
1012	Uplifted Minds School	100

```cpp
void main()
{
    fstream SFIN;
    SFIN.open("SCHOOLS.DAT",ios::binary|ios::in);
    SCHOOLS S;
    SFIN.seekg(5*sizeof(S));
    SFIN.read((char*)&S, sizeof(S));
    S.Display();
    cout<<"Record :"<<SFIN.tellg()/sizeof(S) + 1<<endl;
    SFIN.close();
}
```

SECTION B

[Only for candidates, who opted for Python]

1. (a) Differentiate between Syntax Error and Run-Time Error. Also, write a suitable example in Python to illustrate both. *2*

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

(i) **sin()**

(ii) **search()**

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

```
Val = int(rawinput("Value:"))
Adder = 0


for C in range(1,Val,3)
    Adder+=C
    if C%2=0:
        Print C*10
    Else:
        print C*
print Adder
```

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

```
Data  = ["P",20,"R",10,"S",30]
Times = 0
Alpha = ""
Add   = 0
for C in range(1,6,2):
    Times = Times + C
    Alpha = Alpha + Data[C-1]+"$"
    Add   = Add + Data[C]
    print Times,Add,Alpha
```

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

```python
class GRAPH:
    def __init__(self,A=50,B=100):
        self.P1=A
        self.P2=B
    def Up(self,B):
        self.P2 = self.P2 — B
    def Down(self,B):
        self.P2 = self.P2 + 2*B
    def Left(self,A):
        self.P1 = self.P1 — A
    def Right(self,A):
        self.P1 = self.P1 + 2*A
    def Target(self):
        print "(",self.P1.":",self.P2,")"
G1=GRAPH(200,150)
G2=GRAPH()
G3=GRAPH(100)
G1.Left(10)
G2.Up(25)
G3.Down(75)
G1.Up(30)
G3.Right(15)
G1.Target()
G2.Target()
G3.Target()
```

(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 maximum values that can be assigned to each of the variables BEGIN and LAST.   *2*

```
import random
POINTS=[20,40,10,30,15];
POINTS=[30,50,20,40,45];

BEGIN=random.randint(1,3)
LAST=random.randint(2,4)
for C in range(BEGIN,LAST+1):
   print POINTS[C],"#",
```

(i) 20#50#30#	(ii) 20#40#45#
(iii) 50#20#40#	(iv) 30#50#20#

2. (a)   What is the advantage of super( ) function in inheritance ? Illustrate the same with the help of an example in Python.   *2*

(b)
```
class Vehicle:                          #Line 1       2
    Type = 'Car'                        #Line 2
    def __init__(self, name):           #Line 3
        self.Name = name                #Line 4
    def Show(self):                     #Line 5
        print self.Name,Vehicle.Type    #Line 6

V1=Vehicle("BMW")                       #Line 7
V1.Show()                               #Line 8
Vehicle.Type="Bus"                      #Line 9
V2=Vehicle("VOLVO")                     #Line 10
V2.Show()                               #Line 11
```

(i)   What is the difference between the variable in Line 2 and Line 4 in the above Python code ?

(ii)   Write the output of the above Python code.

(c)   Define a class CONTAINER in Python with the following specifications :   *4*

Instance Attributes

```
- Radius,Height   # Radius and Height of Container
- Type            # Type of Container
- Volume          # Volume of Container
```

Methods

```
- CalVolume()     # To calculate volume
                  # as per the Type of container
                  # With the formula as given below :
```

Type	Formula to calculate Volume
1	3.14 * Radius * Height
3	3.14 * Radius * Height/3

```
- GetValue()      # To allow user to enter values of
                  # Radius, Height and Type.
                  # Also, this method should call
                  # CalVolume() to calculate Volume
- ShowContainer() # To display Radius, Height, Type
                  # Volume of the Container
```

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

```
Class Top1(object):
    def __init__(self,tx):                  #Line 1
        self.X=tx                           #Line 2
    def ChangeX(self,tx):
        self.X=self.X+tx
    def ShowX(self):
        print self.X

Class Top2(object):
    def __init__(self,ty):                  #Line 3
        self.Y=ty                           #Line 4
    def ChangeY(self,ty):
        self.Y=self.Y+ty
    def ShowY(self):
        print self.Y,

class Bottom(Top1,Top2):
    def __init__(self,tz):                  #Line 5
        self.Z=tz                           #Line 6
    Top2.__init__(self,2*tz):               #Line 7
    Top1.__init__(self,3*tz):               #Line 8
    def ChangeZ(self,tz):
        self.Z=self.Z+tz
        self.ChangeY(2*tz)
        self.ChangeX(3*tz)
    def ShowZ(self):
        print self.Z,
        self.ShowY()
        self.ShowX()
    B=Bottom(1)
    B.ChangeZ(2)
    B.ShowZ()
```

(i) Write the type of the inheritance illustrated in the above.

(ii) Find and write the output of the above code.

(iii) What are the methods shown in Line 1, Line 3 and Line 5 known as ?

(iv) What is the difference between the statements shown in Line 6 and Line 7 ?

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

  786, 234, 526, 132, 345, 467

Show the content of the list after the First, Second and Third pass of the bubble sort method used for arranging in **ascending order** ?

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

(b) Write the definition of a method **ZeroEnding(SCORES)** to add all those values in the list of SCORES, which are ending with zero (0) and display the sum. *3*

For example :

If the SCORES contain [200, 456, 300, 100, 234, 678]

The sum should be displayed as 600

(c) Write AddClient(Client) and DeleteClient(Client) methods in Python to add a new Client and delete a Client from a List of Client Names, considering them to act as insert and delete operations of the queue data structure. *4*

(d) Write a definition of a method COUNTNOW(PLACES) to find and display those place names, in which there are more than 5 characters. *2*

For example :

If the list PLACES contains

`["DELHI","LONDON","PARIS","NEW YORK","DUBAI"]`

The following should get displayed :

`LONDON`

`NEW YORK`

(e) Evaluate the following Postfix notation of expression : *2*

  `22,11,/,5,10,*,+,12,-`

4. (a) Write a statement in Python to open a text file STORY.TXT so that new contents can be added at the end of it. *1*

(b) Write a method in Python to read lines from a text file INDIA.TXT, to find and display the occurrence of the word "India". *2*

For example :

If the content of the file is

"India is the fastest growing economy.

India is looking for more investments around the globe.

The whole world is looking at India as a great market.

Most of the Indians can foresee the heights that India is capable of reaching."

The output should be 4.

(c) Considering the following definition of class MULTIPLEX, write a method in Python to search and display all the contents in a pickled file CINEMA.DAT, where MTYPE is matching with the value 'Comedy'. *3*

```
class MULTIPLEX :
    def __init__(self,mno,mname,mtype):
        self.MNO        = mno
        self.MNAME      = mname
        self.MTYPE      = mtype
    def Show(self):
        print self.MNO:"*",self.MNAME,"$",self.MTYPE
```

SECTION C

[For all the candidates]

5. (a) Observe the following tables VIDEO and MEMBER carefully and write the name of the RDBMS operation out of (i) SELECTION (ii) PROJECTION (iii) UNION (iv) CARTESIAN PRODUCT, which has been used to produce the output as shown below. Also, find the Degree and Cardinality of the final result. *2*

TABLE : VIDEO

VNO	VNAME	TYPE
F101	The Last Battle	Fiction
C101	Angels and Devils	Comedy
A102	Daredevils	Adventure

TABLE : MEMBER

MNO	MNAME
M101	Namish Gupta
M102	Sana Sheikh
M103	Lara James

TABLE : FINAL RESULT

VNO	VNAME	TYPE	MNO	MNAME
F101	The Last Battle	Fiction	M101	Namish Gupta
F101	The Last Battle	Fiction	M102	Sana Sheikh
F101	The Last Battle	Fiction	M103	Lara James
C101	Angels and Devils	Comedy	M101	Namish Gupta
C101	Angels and Devils	Comedy	M102	Sana Sheikh
C101	Angels and Devils	Comedy	M103	Lara James
A102	Daredevils	Adventure	M101	Namish Gupta
A102	Daredevils	Adventure	M102	Sana Sheikh
A102	Daredevils	Adventure	M103	Lara James

(b) Write SQL queries for (i) to (iv) and find outputs for SQL queries (v) to (viii), which are based on the tables. *6*

TABLE : ACCOUNT

ANO	ANAME	ADDRESS
101	Nirja Singh	Bangalore
102	Rohan Gupta	Chennai
103	Ali Reza	Hyderabad
104	Rishabh Jain	Chennai
105	Simran Kaur	Chandigarh

TABLE : TRANSACT

TRNO	ANO	AMOUNT	TYPE	DOT
T001	101	2500	Withdraw	2017-12-21
T002	103	3000	Deposit	2017-06-01
T003	102	2000	Withdraw	2017-05-12
T004	103	1000	Deposit	2017-10-22
T005	101	12000	Deposit	2017-11-06

(i) To display details of all transactions of TYPE Deposit from Table TRANSACT.

(ii) To display the ANO and AMOUNT of all Deposits and Withdrawals done in the month of October 2017 from table TRANSACT.

(iii) To display the last date of transaction (DOT) from the table TRANSACT for the Accounts having ANO as 103.

(iv) To display all ANO, ANAME and DOT of those persons from tables ACCOUNT and TRANSACT who have done transactions less than or equal to 3000.

(v) **SELECT ANO, ANAME FROM ACCOUNT**
WHERE ADDRESS NOT IN ('CHENNAI', 'BANGALORE');

(vi) **SELECT DISTINCT ANO FROM TRANSACT;**

(vii) **SELECT ANO, COUNT(*), MIN(AMOUNT) FROM TRANSACT**
GROUP BY ANO HAVING COUNT(*)> 1;

(viii) **SELECT COUNT(*), SUM(AMOUNT) FROM TRANSACT**
WHERE DOT <= '2017-06-01';

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

(b) Draw the Logic Circuit of the following Boolean Expression : *2*

$(U' + V) . (V' + W')$

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

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

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

$G(U,V,W,Z) = \sum(3,5,6,7,11,12,13,15)$

7. (a) Differentiate between Bus Topology and Star Topology of Networks. What are the advantages and disadvantages of Star Topology over Bus Topology ? *2*

(b) Classify each of the following Web Scripting as Client Side Scripting and Server Side Scripting : *2*
   (i) Java Scripting
   (ii) ASP
   (iii) VB Scripting
   (iv) JSP

(c) Write the expanded names for the following abbreviated terms used in Networking and Communications : *2*
   (i) SMTP
   (ii) VoIP
   (iii) GSM
   (iv) WLL

(d) CASE STUDY BASED QUESTION :

Ayurveda Training Educational Institute is setting up its centre in Hyderabad with four specialised departments for Orthopedics, Neurology and Pediatrics along with an administrative office in separate buildings. The physical distances between these department buildings and the number of computers to be installed in these departments and administrative office are given as follows. You, as a network expert, have to answer the queries as raised by them in (i) to (iv).

Shortest distances between various locations in metres :

Administrative Office to Orthopedics Unit	55
Neurology Unit to Administrative Office	30
Orthopedics Unit to Neurology Unit	70
Pediatrics Unit to Neurology Unit	50
Pediatrics Unit to Administrative Office	40
Pediatrics Unit to Orthopedics Unit	110

Number of Computers installed at various locations are as follows :

Pediatrics Unit	40
Administrative Office	140
Neurology	50
Orthopedics Unit	80
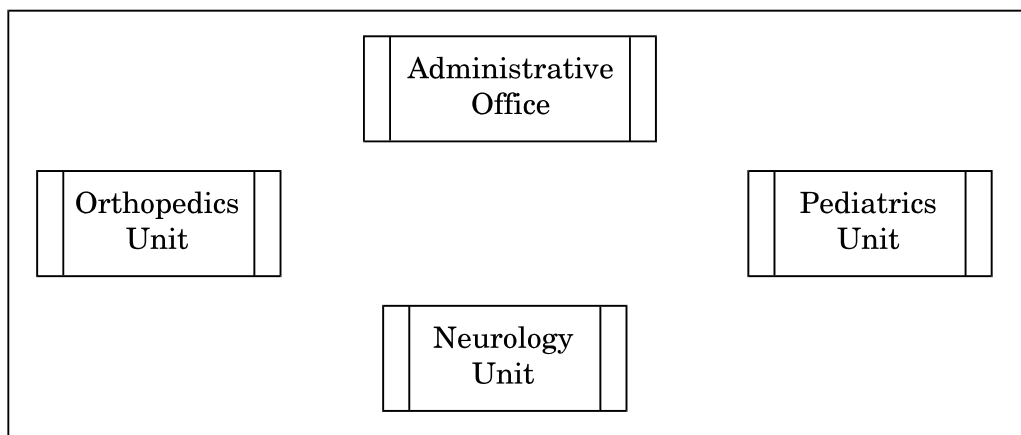
(i) Suggest the most suitable location to install the main server of this institution to get efficient connectivity. *1*

(ii) Suggest the best cable layout for effective network connectivity of the building having server with all the other buildings. *1*

(iii) Suggest the devices to be installed in each of these buildings for connecting computers installed within the building out of the following : *1*

- Gateway
- Modem
- Switch

(iv) Suggest the topology of the network and network cable for efficiently connecting each computer installed in each of the buildings out of the following : *1*

Topologies : Bus Topology, Star Topology

Network Cable : Single Pair Telephone Cable, Coaxial Cable, Ethernet Cable