

Roll No.

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

- Please check that this question paper contains **16** 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 :

- SECTION A* refers to programming language C++.
- SECTION B* refers to programming language Python.
- SECTION C* is compulsory for all.
- Answer either *SECTION A* or *SECTION B*.
- It is compulsory to mention on the page 1 in the answer book whether you are attempting *SECTION A* or *SECTION B*.
- All* questions are compulsory within each section.

SECTION – A

(Only for Candidates, who opted for C++)

- (a) Write the type of C++ tokens (keywords and user-defined identifiers) from the following: **2**
 - struct**
 - return**
 - else**
 - stack**

- (b) The following C++ code during compilation reports errors as follows: 1
Error: 'ofstream' not declared
Error: 'strcpy' not declared
Error: 'strcat' not declared
Error: 'F' not declared
Write the names of the correct header files, which must be included to compile the code successfully:

```
void main()
{
    ofstream F("WELCOME.TXT");
    char Word1[]="WELCOME";
    char Word2[]="C++";
    char Word[40];
    strcpy(Word, Word1);
    strcat(Word, Word2);
    F<<Word<<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 Number int;
void main()
{
    Number N;
    cout<<"Enter an integer";
    cin>>N ;
    for (I = 1; I<=N; I++)
    cout<< N "*" I <<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 Turn(int &K, int Count=2)
{
    Count=(Count%2==0) ?Count+1:Count-1;
    for(int I=1; I<=Count; I++)
        K+=I ;
}
void main()
{
    int N=10,M=5;
    Turn (N,M) ;
    cout<<N<<"#"<<M<<endl ;
    M--;
    Turn (N,M) ;
    cout<<N<<"#"<<M<<endl ;
    Turn (N) ;
    cout<<N<<"#"<<M<<endl ;
}
```

- (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.

```
#define Change(X) X*2+100
void main()
{
    int A[]={20,25,22,27};
    int *Ptr=A, I;
    for(I=3; I>=0; I--)
        A[I]=Change(A[I]);
    for (I=0; I<=3; I++)
    {
        cout<<*Ptr<<" ";
        Ptr++;
    }
}
```

- (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 T. 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

```
void main()
{
    randomize();
    int T[4], I;
    for(I=0; I<4; I++)
        T[I]=random(I+1)+1;
    for(I=3; I>=0; I--)
        cout<<T[I]<<"$";
}
```

| | |
|--------------|--------------|
| (i) | (ii) |
| 4\$3\$1\$1\$ | 0\$1\$2\$3\$ |
| (iii) | (iv) |
| 3\$2\$1\$0\$ | 1\$2\$3\$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 Compute(int A,char B); //Function 1
void Compute(char A,int B); //Function 2
int Compute(int A); //Function 3
void Compute(); //Function 4
void Compute(int &K); //Function 5
void Compute(int P); //Function 6
```

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- (b) Observe the following C++ code and answer the questions (i) and (ii).

Note: Assume all necessary files are included.

```
class ONE
{
    int Data1;
public:
    void Show()                //Member Function 1
    {
        cout<<Data1<<endl;
    }
};
class TWO: public ONE
{
    int Data2;
public:
    void Show()                //Member Function 2
    {
        cout<<Data2<<endl;
    }
};
void main()
{
    TWO T;
    _____                //Statement 1
    _____                //Statement 2
}
```

- (i) Which Object Oriented Programming feature is illustrated by the definitions of classes ONE and TWO ? 1
- (ii) Write Statements 1 and Statement 2 to execute Member Functions 1 and Member Function 2 respectively using the object T. 1
- (c) Write the definition of a class FIGURE in C++ with following description: 4

Private Members

- Sides // integer
- Shape // char array of size 20
- AssignShape() // Member function to assign value of
// Shape based upon Sides as follows:

| Sides | Shape |
|-------|---------------|
| <3 | Open |
| ==3 | Triangle |
| ==4 | Quadrilateral |
| >5 | Polygon |

Public Members

- GetFigure() //A function to allow user to enter value
// of Sides. Also, this function should
// call Assign () to assign value of Shape
- ShowFigure() // A function to display Sides and Shape

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

4

```
class First
{
    int Data1;
protected:
    float Data2;
public:
    First();
    void Get1(); void Show1();
};
class Second
{
    int Data3;
protected:
    float Data4;
public:
    Second();
    void Get2();
    void Show2();
};
class Third : public Second, private First
{
    int Data5;
public:
    Third();
    void Get3();
    void Show3();
};
void main()
{
    Third T;
}
```

- (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 Show3() of class Third.
- (iii) Write the names of all the members, which are directly accessible by the object T of class Third declared in the main() function.
- (iv) What will be the order of execution of the constructors, when the object T of class Third is declared inside main() function ?

3. (a) Write the definition of a function **Sum(int Arr[], int N)** in C++, which should display the sum of even locations and sum of odd locations separately. Example: if the array Arr contains 2

| | | | | |
|----|----|----|----|---|
| 0 | 1 | 2 | 3 | 4 |
| 15 | 23 | 12 | 17 | 8 |

Then the functions should display the output as :

Sum of even locations = 35 (i.e. 15+12+8)

Sum of odd locations = 40 (i.e. 23+17)

- (b) Write definition for a function **ShowHalf(int Mat[4][4])** in C++, which displays the elements on and below the diagonal AC for the matrix ABCD in their respective row and column positions. 3

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

| | | | | |
|---|----|----|----|----|
| A | | | | B |
| | 11 | 21 | 13 | 24 |
| | 12 | 31 | 14 | 52 |
| | 23 | 34 | 25 | 16 |
| | 43 | 15 | 26 | 37 |
| D | | | | C |

The function should display the following :

11
12 31
23 34 25
43 15 26 37

- (c) Let us assume N[23][30] is a two dimensional array, which is stored in the memory along the row with each of its element occupying 4 bytes, find the address of the element N[15][25], if the element N[25][10] is stored at the memory location 25000. 3

- (d) Write the definition of a member function AddBOX() for a class Queue in C++, to add/insert a BOX in a dynamically allocated Queue of BOXes considering the following code is already written as a part of the program. 4

```
struct BOX
{
    int BNO;
    char DESTINATION[20];
    BOX *LINK;
};
class QUEUE
{
    BOX *Front, *Rear;
public:
    QUEUE () {Front=NULL;Rear=NULL;}
    void AddBOX ();
    void RemoveBOX ();
    ~QUEUE ();
};
```

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

A / B + C * (D - E)

4. (a) A text file named **TOPIC.TXT** contains some text, which needs to be displayed such that every next character appears after a gap of a tab-space. 3

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

Example:

If the file **TOPIC.TXT** has the following content stored in it:

MY FILE

The function **TabDisplay()** should display the following content:

M Y F I L E

(Assuming space between every two characters is a tab-space i.e. “\t”)

- (b) Write a definition for function FindAverage() in C++ to read each object of a binary file ITEMS.DAT, find Average Price of the Items stored in the file and display the same. Assume that the file ITEMS.DAT is created with the help of objects of class ITEMS, which is defined below : 2

```
class ITEMS
{
    int INo; char IName[20]; float Price;
public:
    void SHOWVAL ()
    {cout<<INo<<"#"<<IName<<"#"<<Price<<endl;}
    float RPRICE () {return Price;}
};
```

NOTE :

Average Price = (Total Price of all Items) ÷ Number of Items

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

| INo | IName | Price |
|-----|-----------|-------|
| T1 | Pen | 10 |
| T2 | Pencil | 15 |
| T3 | Notebook | 30 |
| T4 | Eraser | 5 |
| T5 | Scale | 5 |
| T6 | PencilBox | 40 |
| T7 | Scale | 5 |
| T8 | Compass | 20 |
| T9 | Labels | 2 |
| T10 | Bags | 100 |

```
void main()
{
    fstream FIN;
    FIN.open("ITEMS.DAT", ios::binary|ios::in);
    ITEMS ITM;
    FIN.seekg(5*sizeof(ITM));
    FIN.read((char*)&ITM, sizeof(ITM));
    ITM.SHOWVAL();
    cout<<"Record:"<<FIN.tellg()/sizeof(ITM)+ 1<<endl;
    FIN.close();
}
```

SECTION – B

[Only for candidates, who opted for Python]

1. (a) Differentiate between Run-Time Error and Logical 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) `log()` (ii) `match()`
- (c) Rewrite the following code in python after removing all syntax error(s). Underline each correction done in the code. 2

```
Num = int(rawinput("Number:"))
Sum = 0
for i in range(10,Num,3)
    Sum+=i
    if i%2=0:
        print i*2
    Else:
        print i*3
print Sum
```


- (d) Find and write the output of the following python code : 2

```
Val = [20, "A", 40, "K", 10, "H"]
Freq = 0
Sum = 0
Cat = ""
For I in range(1,6,2):
    Freq = Freq + I
    Sum = Sum + Val[I-1]
    Cat = Cat + Val[I] + "*"
print Freq,Sum,Cat
```

- (e) Find and write the output of the following python code : 3

```
class POINT:
    def __init__(self,X=100,Y=150):
        self.PX=X
        self.PY=Y
    def Up(self,Y):
        self.PY = self.PY - Y
    def Dn(self,Y):
        self.PY = self.PY + 2*Y
    def Lt(self,X):
        self.PX = self.PX - X
    def Rt(self,X):
        self.PX = self.PX + 2*X
    def Location(self):
        print "(" ,self.PX, ":", self.PY, ")"
P1=POINT(20,100)
P2=POINT()
P3=POINT(50)
P1.Lt(10)
P2.Up(25)
P3.Dn(75)
P1.Up(30)
P3.Rt(15)
P1.Location()
P2.Location()
P3.Location()
```

- (f) What possible outputs(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 START and END. 2

```
import random
SCORE=[20,40,10,30,15];
START=random.randint(1,3)
END=random.randint(2,4)
for I in range(START,END+1):
print SCORE[I],"&",
```

| | |
|-----------------|----------------|
| (i) 10&40&20& | (ii) 10&30&15& |
| (iii) 40&10&30& | (iv) 20&40&10& |

2. (a) What is method overriding in inheritance ? Write a code in Python illustrating the same. 2

(b) `class Animal:` #Line 1
 Type = 'Dog' #Line 2
 def __init__(self, name): #Line 3
 self.Name = name #Line 4
 def Show(self): #Line 5
 print self.Name,Animal.Type #Line 6
 A1=Animal("Bruno") #Line 7
 A1.Show() #Line 8
 Animal.Type="Horse" #Line 9
 A2=Animal("Chetak") #Line 10
 A2.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 FIGURE in Python with following specifications : 4

Instance Attributes

- Sides # No. of sides
- Shape # Name of the Shape

Methods

- AssignShape() # To assign value of Shape
 # based upon Sides as follows:

| Sides | Shape |
|-------|---------------|
| <3 | Open |
| ==3 | Triangle |
| ==4 | Quadrilateral |
| >5 | Polygon |

- GetFigure() # To allow user to enter value of
Sides. Also, this method should call
Assign() to assign value of Shape
- ShowFigure() # To display Sides and Shape

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

4

```
class CA(object):
def __init__(self,i) :           #Line 1
self.A=i                         #Line 2
def ChangeA(self,i) :
self.A=self.A+i
def AShow(self) :
print self.A
class CB(object):
def __init__(self,i) :         #Line 3
self.B=i                       #Line 4
def ChangeB(self,i) :
self.B=self.B+i
def BShow(self) :
print self.B,
class CC(CA,CB) :
def __init__(self,i) :         #Line 5
self.C=i                       #Line 6
CB.__init__(self,2*i)         #Line 7
CA.__init__(self,3*i)         #Line 8
def ChangeC(self,i) :
self.C=self.C+i
self.ChangeB(2*i)
self.ChangeA(3*i)
def CShow(self) :
print self.C,
self.BShow()
self.AShow()
```

IC=CC(1)

IC.ChangeC(2)

IC.CShow()

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

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3. (a) Consider the following randomly ordered numbers stored in a list 3
806, 304, 506, 102, 405, 607
Show the content of 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 definition of a method **Endingwith5(SCORES)** to add all those values in the list of SCORES, which are ending with 5 and display the sum. 3
For example,
If the SCORES contain [205,506,365,100,230,335]
The sum should be displayed as 905
- (c) Write AddCustomer(Customer) and DeleteCustomer(Customer) methods in Python to add a new Customer and delete a Customer from a List of Customer Names, considering them to act as insert and delete operations of the queue data structure. 4
- (d) Write definition of a Method COUNTNOW(REGIONS) to find and display names of those REGIONS, in which there are less than or equal to 5 characters. 2
For example :
If the list REGIONS contains
["GOA", "NEW DELHI", "DAMAN", "CHENNAI", "BANGALORE"]
The following should get displayed
GOA
DAMAN
- (e) Evaluate the following Postfix notation of expression : 2
12,3,/,9,2,*,+,11,-
4. (a) Write a statement in Python to open a text file NOTES.TXT so that new contents can be written in 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" or "India". 2
For example:
If the content of the file is
-
- INDIA is a famous country all over the world.
Geographically, India is located to the
south of Asia continent. India is a high
population country and well protected
from all directions naturally.
India is a famous country for
its great cultural and traditional
values all across the world.**
-
- The output should be 4

- (c) Considering the following definition of class SHOPCOMPLEX, write a method in python to search and display all the content in a pickled file SHOP.DAT, where STYPE is matching with the value 'Stationary'. 3

```
class SHOPCOMPLEX:  
    def __init__(self, sno, sname, stype):  
        self.SNO      = sno  
        self.SNAME   = sname  
        self.STYPE   = stype  
    def Display(self):  
        print self.SNO, ", ", self.SNAME, "#", self.STYPE
```

SECTION – C

(For all the candidates)

5. (a) Observe the following tables BOOK 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 in RESULT ? Also, find the Degree and Cardinality of the RESULT. 2

TABLE: BOOK

| BNO | BNAME | TYPE |
|------|------------------|------------|
| C101 | Red Scorpion | Comic |
| F101 | The Last Wish | Fiction |
| L102 | French in a week | Literature |

TABLE: MEMBER

| MNO | MNAME |
|------|---------------|
| M101 | Ritu Oberoi |
| M102 | Fatima |
| M103 | Jenny DeSouza |

TABLE: RESULT

| BNO | BNAME | TYPE | MNO | MNAME |
|------|------------------|------------|------|---------------|
| C101 | Red Scorpion | Comic | M101 | Ritu Oberoi |
| C101 | Red Scorpion | Comic | M102 | Fatima |
| C101 | Red Scorpion | Comic | M103 | Jenny DeSouza |
| F101 | The Last Wish | Fiction | M101 | Ritu Oberoi |
| F101 | The Last Wish | Fiction | M102 | Fatima |
| F101 | The Last Wish | Fiction | M103 | Jenny DeSouza |
| L102 | French in a week | Literature | M101 | Ritu Oberoi |
| L102 | French in a week | Literature | M102 | Fatima |
| L102 | French in a week | Literature | M103 | Jenny DeSouza |

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

TABLE : CUSTOMER

| CNO | CNAME | ADDRESS |
|-----|--------------|-----------|
| 101 | Richa Jain | Delhi |
| 102 | Surbhi Sinha | Chennai |
| 103 | Lisa Thomas | Bangalore |
| 104 | Imran Ali | Delhi |
| 105 | Roshan Singh | Chennai |

TABLE : TRANSACTION

| TRNO | CNO | AMOUNT | TYPE | DOT |
|------|-----|--------|--------|------------|
| T001 | 101 | 1500 | Credit | 2017-11-23 |
| T002 | 103 | 2000 | Debit | 2017-05-12 |
| T003 | 102 | 3000 | Credit | 2017-06-10 |
| T004 | 103 | 12000 | Credit | 2017-09-12 |
| T005 | 101 | 1000 | Debit | 2017-09-05 |

- (i) To display details of all transactions of TYPE Credit from Table TRANSACTION.
- (ii) To display the CNO and AMOUNT of all Transactions done in the month of September 2017 from table TRANSACTION.
- (iii) To display the last date of transaction (DOT) from the table TRANSACTION for the customer having CNO as 103.
- (iv) To display all CNO, CNAME and DOT (date of transaction) of those CUSTOMERS from tables CUSTOMER and TRANSACTION who have done transactions more than or equal to 2000.
- (v) **SELECT COUNT (*), AVG (AMOUNT) FROM TRANSACTION
WHERE DOT >= '2017-06-01' ;**
- (vi) **SELECT CNO, COUNT (*), MAX (AMOUNT) FROM TRANSACTION
GROUP BY CNO HAVING COUNT (*) > 1 ;**
- (vii) **SELECT CNO, CNAME FROM CUSTOMER
WHERE ADDRESS NOT IN ('DELHI', 'BANGALORE') ;**
- (viii) **SELECT DISTINCT CNO FROM TRANSACTION ;**

6. (a) State any one De Morgan's Law of Boolean Algebra and verify it using truth table. **2**
 (b) Draw the Logic Circuit of the following Boolean Expression : **2**
 $(X' + Y') \cdot (X + Z')$

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

| P | Q | R | F (P, Q, R) |
|---|---|---|-------------|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 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**
 $F(W, X, Y, Z) = \Sigma(1, 4, 5, 7, 9, 13, 14, 15)$

7. (a) Differentiate between Packet and Circuit Switching techniques. **1**
 (b) Differentiate between MAN and LAN with the help of an example. **1**
 (c) Differentiate between Microwave and Radio Link in context of wireless communication medium. What are the advantages and disadvantages of using Microwave instead of Radio Link ? **2**
 (d) Write the expanded names for the following abbreviated terms used in Networking and Communications: **2**
 (i) GPRS (ii) WiFi (iii) POP (iv) SMTP
 (e) CASE STUDY BASED QUESTION

Medico Training Educational Institute is setting up its centre in Poona with four specialised units for Radiology, Neurology and ENT alongwith an administrative office in separate buildings. The physical distances between these units and the number of computers to be installed in these units and administrative office as given as follows. You as a network expert have to answer the queries as raised by them in (i) to (iv).

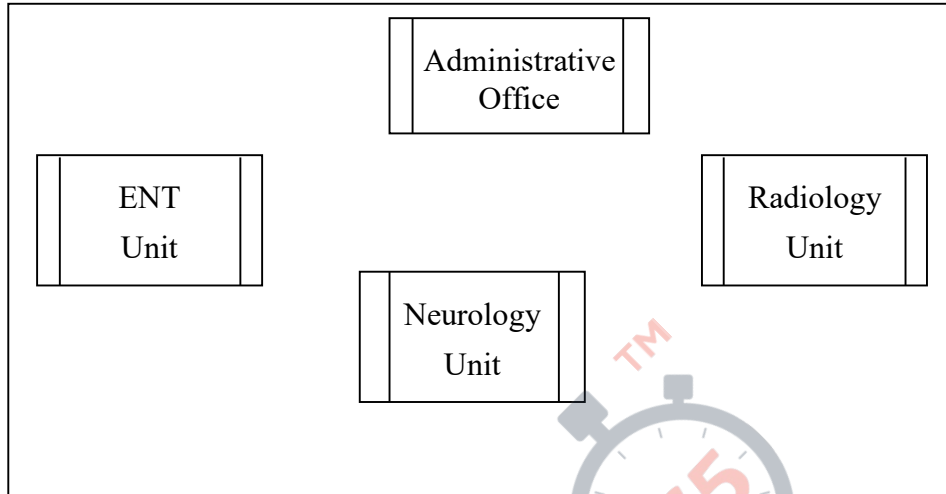
Shortest distances between various locations in metres :

| | |
|---|-----|
| Administrative Office to Radiology Unit | 60 |
| Neurology Unit to Administrative Office | 40 |
| Radiology Unit to Neurology Unit | 80 |
| ENT Unit to Neurology Unit | 60 |
| ENT Unit to Administrative Office | 30 |
| ENT Unit to Radiology Unit | 120 |

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Number of Computers installed at various locations are as follows :

| | |
|-----------------------|-----|
| ENT Unit | 50 |
| Radiology Unit | 70 |
| Administrative Office | 120 |
| Neurology | 40 |



- (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**
- Modem
 - Switch
 - Gateway
- (iv) Suggest the topology of the network and network cable for efficiently connecting each computer installed in each of the building out of the following : **1**
- Topologies : Star Topology, Bus Topology
- Network Cable : Co-axial Cable, Ethernet Cable, Single Pair Telephone Cable.