Time : 3 Hours   **COMPUTER SCIENCE**

Subject Code

| H | 4 | 7 | 0 | 5 |

Total No. of Questions : 35   (Printed Pages : 15)   Maximum Marks : 70

INSTRUCTIONS : (*i*)   *All* questions are compulsory, however there is an internal choice for question number **31, 32, 34** and **35**.

(*ii*)   Question number **1 to 7** should be attempted only once.

(*iii*)   Programs should be written in C++ only.

(*iv*)   State your assumptions clearly :

Section A : Consists of **14** questions of **1** mark each.

Section B : Consists of **10** questions of **2** marks each.

Section C : Consists of **8** questions of **3** marks each.

Section D : Consists of **3** questions of **4** marks each.

SECTION – 'A'

1.   Write the **CORRECT** alternative from those given below :   1

What will be the value of "a" after evaluating the following C++ arithmetic expression ?

int a = 4 + 4*2/5 + 20;

- 20

- 23

- 24

- 25

2. Write the **CORRECT** alternative from those given below :   1

While evaluating a postfix expression, consider that the current status of the stack is top → 5, 4, 6, 6. At this point if operator '−' is encountered in the postfix expression, then which of the following step needs to be performed ?

- − is pushed into the stack

- 5 − 4 = 1 is pushed on to the stack

- 4 − 5 = − 1 is pushed on to the stack

- 6 − 6 = 0 is pushed on to the stack

3. Write the **CORRECT** alternative from those given below :   1

Which of the following algorithm sorts the list by swapping the entries whenever pair of adjacent keys are out of desired order ?

- Insertion sort

- Selection sort

- Bubble sort

- Merge sort

4. Write the **CORRECT** alternative from those given below :   1

If we are opening a file using an object of ofstream class, then default mode/ modes of opening the file is ....

- ios::app

- ios::out

- ios::in | ios::trunc

- ios::out | ios::trunc

5. Write the **CORRECT** alternative from those given below :   1

The complement of $A + \overline{BC}$ is ....

* $A \cdot \overline{B} + \overline{C}$

* $\overline{ABC}$

* $A \cdot (\overline{B} + \overline{C})$

* $\overline{A} \, \overline{B} \, \overline{C}$

6. Write the **CORRECT** alternative from those given below :   1

Which of the following is a valid IP address ?

*   678.13.765.78

*   197.185.345.12

*   1.999.231.210

*   0.196.45.0

7. Write the **CORRECT** alternative from those given below :   1

Which of the following is *not* a transmission medium ?

*   Telephone lines

*   Coaxial cable

*   Modem

*   Microwave

8. What is function overloading ? 1

9. Define the term data encapsulation in the context of OOPs. 1

10. Which data structure follows FIFO mechanism ? 1

11. Name the stream used for reading only from a file. 1

12. What is a logic gate ? 1

13. What is a repeater in context to Computer networks ? 1

14. Name the protocol that enables files to be transferred between computers. 1

SECTION – 'B'

15. Consider the following class declaration and answer the questions given below it : 2

    class JOB

    {

        int jobid;

        char jobtype;

    public:

        ~JOB() {cout<<"Resigned";} //Function 1

        JOB(int x, char y) { jobid=x; jobtype=y;} //Function 2

    };

    (*i*) What is function 1 called in context to OOPS ? When does it get invoked ?

    (*ii*) What is function 2 called in context to OOPS ? Write a statement in C++ to invoke function 2.

16. Determine the output of the following C++ program : 2

```cpp
int a=18;

void trial(int &x, int z=15)

{

        x %=z;

        z -=5;

}

int main()

{

    int a=5;

    trial(::a);

    cout<<::a<<" : "<<a<<endl;

    trial(a,::a);

    cout<<::a<<" : "<<a<<endl;

}
```

17. State **TWO** points of difference between singly linked list and doubly linked list. 2

18. Sort the following numbers in ascending order using selection sort and show the contents of the array at the end of each pass : 2

<p align="center">52, 22, 89, 96, 34</p>

19. Assuming that "fin" is the input file stream object and "fout" is the output file stream object, answer the following questions : 2

   (*i*) Write a C++ statement to move the get pointer forward by 25 bytes from the current position in the file.

   (*ii*) Write a C++ statement to move the put pointer backward by 10 bytes from the end of the file.

20. Assuming that "data.txt" is an already existing text file, write a function COUNT() in C++ to count and return the number of capital letters present in the text file. 2

21. Obtain the simplified Boolean expression for the following logic circuit diagram : 2
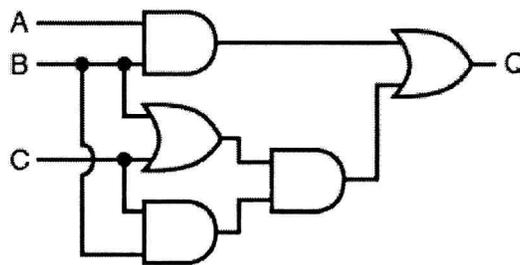
22. Write a short note on Packet switching. 2

23. Draw a diagram to show how five computers can be connected in STAR topology. Also write **ONE** advantage and **ONE** disadvantage of STAR topology. 2

24. State any **TWO** points of difference between LAN and WAN. 2

SECTION – 'C'

25. Simplify the following Boolean expression in POS form and draw the logic circuit diagram for the simplified expression using NOR gates only :   3

$$F(A, B, C) = \Sigma (4, 5, 7)$$

26. Define a class "Tourist" in C++ with the following specification :   3

Private Data members :

- Cno – type integer, to store cab number

- Ctype – to store character 'A', 'B' or 'C' as city type

- Perkm – type float, to store per kilo meter charges

- Distance – type float, to store distance travelled in kilometers

- Amount – of type float, to be calculated as Perkm × Distance

- Assign() – to assign the data member Perkm as per the following table :

Ctype	Perkm
A	20
B	18
C	15

Public member function :

- readdata() – to allow user to enter Cno, Ctype and Distance, and also call the function Assign() to assign the data member Perkm.

- displaydata() – to calculate the Amount and display all the data members on the screen.

27. Consider the following class declarations and answer the question (*i*) to (*iv*) based on the same : 3

```
class EXTERIOR

{
                int ordered;

                char address[20];

        protected :

                        foat advance;

        public:

                EXTERIOR();

                void book();

                void show();

};

class PAINT : public EXTERIOR

{
                int wallarea, colorcode;

        protected:

                char type;

        public :

                PAINT();

                void Pbook();
```

};

class BILL : public PAINT

{

    float charges;

    void calculate();

  public:

    BILL();

    void Billing();

};

(*i*) Which type of inheritance is shown above ?

(*ii*) Write the names of all the members, which are directly accessible from the member functions of class PAINT.

(*iii*) Write the names of all the member functions, which are directly accessible from an object of class BILL.

(*iv*) What will be the order of execution of constructors, when an object of class BILL is declared ?

28. Convert the following infix expression to its equivalent postfix expression and show the stack content after every step : 3

$$A/(B + C)* D - E$$

29. Obtain simplified SOP Boolean expression for the following expression using K-map and draw the logic circuit diagram for the simplified expression using NAND gates only : 3

$$F(A, B, C, D) = A\overline{B}C\overline{D} + BC\overline{D} + \overline{A}C\overline{D} + \overline{B}CD + \overline{C}\,\overline{D}$$

30. Complete the following function definition to check and return 1 if matrix A of order n × n is a skew symmetric matrix or 0 otherwise. 3

int IS_SKEWSYM(int A[][50], int n)

{

}

Note : A square matrix is said to be skew symmetric if it is equal to the negative of its transpose matrix.

For example $\begin{bmatrix} 0 & 1 & -2 \\ -1 & 0 & 3 \\ 2 & -3 & 0 \end{bmatrix}$ is skew symmetric matrix.

31. Write a complete procedural C++ program to check if a given number is a neon number or not. 3

For example : Original Number = 9

Square of 9 = 81

Sum of 81 = 8 + 1 = 9 = original number.

Therefore 9 is a neon number.

OR

Write a complete procedural C++ program to convert a given binary number N (of type integer) to its equivalent decimal number.

32. Assuming that A is an 1-D array containing 'n' integers in ascending order, write a function in C++ to remove duplicate values present in the array. 3

For example :

If original array is

| 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 |

The output array should be

| 1 | 2 | 3 | 4 |

OR

Complete the following function definition to find array C such that C = A – B (set difference) i.e. C should contain elements of A which are not present in B.

void setdifference (int A[], int m, int B[], int n)

{

....

....

}

For example :

If A is

| 4 | 8 | 3 | 9 | 1 | 7 |

And B is

| 8 | 2 | 5 | 6 | 9 |

The C should have

| 4 | 3 | 1 | 7 |

SECTION – 'D'

33. Declare an abstract class named STUDENT with the following members :

    (*i*)   rollno-of type integer under private visibility label 4

    (*ii*)   Parameterised constructor which will only initialise the data member rollno.

    (*iii*) Show() – A function under protected visibility to display the data member rollno.

    Declare another abstract class named TEACHER with the following members –

    (*i*)   tcode (teacher code) – of type integer under private visibility label

    (*ii*)   Parameterised constructor which will only initialise the data member tcode

    (*iii*) show() – A function under protected vbisibility to display the data member tcode.

    Derive a class COURSE from class STUDENT and class TEACHER both in public mode. The class should have the following members :

    (*i*)   ccode (Course code) – of type integer under private visibility label

    (*ii*)   A parameterised constructor which will only initialise the data member ccode.

    (*iii*) show() – A function under public visibility to display the data member ccode.

    Write main() function to create an object of type COURSE and display data member of all the classes.

34. Assuming that voters.dat is an already existing binary file consisting of objects of the following class type. 4

class VOTERS

{

    int voterid;

    char name[30];

    char geneder, /*where gender is M for male, F for female and O for others */ public :

       void getdata();   //function to read the data members

       void showdata();   //function to display the data members

       char getgender()   {return gender;}

};

Write a function in C++ to copy the details of all male voters from voters.dat file to a new binary file called male.dat and also copy details of all female voters from voters.dat file to another new binary file called female.dat.

OR

Consider the following class declaration :

class VOLUNTEERS

{

    char name[30], city[20];

    int age;

    public:

void indata(); //function to read the data members

void outdata(); //function to display the data members

int getage()

{return(age);}

};

Assuming that "north.dat" contains details of volunteers from North Goa & "south.dat" contains details of volunteers from South Goa, write a C++ function to transfer the details of all volunteers from "north.dat" whose age lies in the range from 18 to 25 to a new binary file called "collect.dat". Append the details of all volundeers in the given range of age from south.dat to the binary file collect.dat.

35. Consider the following class declaration : 4

class LIST

{

    struct node

    {

        int rno;

        float score;

        node *link;

    }* start;

    public:

    LIST() {start=NULL;}

    void create(); //creates linked list of n nodes

```
        void insert();

};
```

Write a function definition for insert() to insert a node at position $P(1 \le P \le n+1)$ in the linked list.

<div align="center">

OR

</div>

Consider the following class declaration :

```
class LIST
{
    struct node
    {
        int itemno;
        char name[30];
        node *link;
    }*start;
    public:
        LIST() {start=NULL;}
        void create();          //creates linked list of n nodes
        void remove();
};
```

Write a function definition for remove() to delete a node at position $P(1 \le P \le n)$ from the linked list.