

# CBSE Class 12 Computer Science 2021 - 491 (Set-4) C++ - Compartment



## Question Paper

Conducted by the Central Board of Secondary Education (CBSE)

**Time Allowed: 3 Hours**

**Maximum Marks: 70**

### General Instructions

- (i) This C++ version contains 7 main questions: the C++ programming option and the common section.
- (ii) The official paper offers Section A (C++) or Section B (Python). This version includes Section A and the compulsory Section C.
- (iii) Attempt all questions in the selected programming section and in Section C.
- (iv) State the selected programming section on the first page of the answer-book.
- (v) Follow any internal choices printed with individual questions.
- (vi) Internal choices are provided in Questions 2(b), 2(d), 3 and 4.

**1(a).** Write the type of C++ Operators (Arithmetic, Relational or Logical Operators) from the following :

1. ||
2. <=
3. %
4. \*

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

```
void main()
{
    char STR[]="india2020";
    STR[0]=toupper(STR[0]);
    puts(STR);
}
```

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

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

```
Typedef float REAL;
void main()
{
    REAL Pie=3.1416,R,AREA;
    cin<<R;
    AREA=Pie*R*R;
    cout>>'Area: '>>AREA>>endl;
}
```

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

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

```
void Manip(char S[])
{
    for(int I=0;S[I]!='\0'; I++)
        if (I%2 == 0)
            if (S[I]>='A' && S[I]<='M')
                S[I]=tolower(S[I]);
            else
                S[I]='#';
        else
            if (S[I]>='N' && S[I]<='Z')
                S[I]='*';
            else
                S[I]=S[I]+1;
}
void main()
{
    char TXT[]="CaNW2GeT";
    Manip(TXT);
    cout<<TXT<<endl;
}
```

**1(e).** Find and write the output of the following C++ program code :

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

```
void Exchange (int &A, int B=2)
{
    A+=B;
    B=A-B;
    cout<<2*A<<"@"<<4*B<<endl;
}
void main()
{
    int P=100, Q=50;
    Exchange(Q);
    Exchange(P,Q);
    Exchange(P);
}
```

**1(f).** Look at the following C++ code and find which output(s) from the given options is/are not possible. Also, write the minimum and maximum values that can possibly be assigned to the variable Val.

Note :

- Assume all the required header files are already being included in the code.
- The function random(N) generates any possible integer between 0 and N-1 (both values included).

```
void main()
{
    randomize();
    int A[4],Val;

    for(int I=3; I>=0; I--)
    {
        Val = random(2+I) + 11;
        A[I]=Val;
    }
    for (I=0;I<4;I++)
        cout<<A[I]<<"@";
}
```

- (A) 12@11@11@14@      (B) 10@13@14@13@  
(C) 12@11@13@14@      (D) 11@13@12@13@

**2(a).** Given the following class Packer and assuming all necessary header file(s) included, answer the questions that follow the code:

```
class Packer
{
    int PID; float WT;
public:
    Packer(int ID)
//Function 1
    {
        PID = ID;
    }
    Packer()
//Function 2
    {
        PID = 1001;
        WT = 100;
    }
    Packer(Packer &P)
//Function 3
    {
        PID = P.PID + 1;
        WT = P.WT + 10;
    }
    Packer(float W)
//Function 4
    {
        WT = W;
    }
    Packer(int ID, float W)
//Function 5
    {
        PID = ID;
        WT = W;
    }
};

void main()
{
    Packer P1;           //Statement I
    Packer P2(70);       //Statement II
    _____;         //Statement III
}
```

**2(a)(i).** Which function out of 1, 2, 3, 4 and 5 is a Copy Constructor and which one is a default constructor in the definition of class Packer ?

**2(a)(ii).** Write the Statement III, to declare an object P3 of class Packer with two parameters 75 and 32.5.

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

Note : Assume all necessary files are included.

```
class Store
{
    int SID;
public:
    Store(int ID=10)
//Function 1
    {
        SID=ID;
        cout<<"Store"<<SID<<"Opened"
<<endl;
    }
    ~Store()
//Function 2
    {
        cout<<"Store Closed"<<endl;
    }
    void Display()
//Function 3
    {
        cout<<"Store "<<SID<<" is Active"
<<endl;
    }
};
void main()
{
    Store S(25);
    S.Display();
}
```

**2(b)(i).** What is the output of the above code, on execution ?

**2(b)(ii).** For the class Store, what is Function 2 known as ? When does this function get executed ?

OR

**2(b).** Explain Copy Constructor in context of Object Oriented Programming. Also give a supporting example in C++.

**2(c).** Write the definition of a class ACCESSORY in C++ with the following description :

Private Members

- ANO // integer
- TYPE // char array of size 20
- SECTION // char
- SECASSIGN() /\* Member function to assign value of SECTION based upon TYPE as follows : \*/

| TYPE     | SECTION |
|----------|---------|
| MOBILE   | A       |
| COMPUTER | B       |
| CAMERA   | C       |
| FASHION  | D       |

Public Members

- GetOne() /\* Function to allow user to enter values of ANO and TYPE then invoke SECASSIGN() to assign SECTION \*/
- ShowOne() /\* Function to display values of ANO, TYPE and SECTION \*/

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

```
class GM
{
    int MID;
protected:
    double Sal;
    void Calc();
public:
    void Enter();
    void Display();
};

class DIRECTOR
{
    int DID;
protected:
    double Fees;
public:
    void Enter(); void Display();
};

class STORE: private DIRECTOR, public GM
{
    int STID;
public:
    void Enter(); void Display();
};

void main()
{
    STORE ST;
    _____; //Statement
}
```

1. Which type of Inheritance out of the following is illustrated in the above example ? – Single Level Inheritance, Multilevel Inheritance, Multiple Inheritance
2. Write the names of all the data members, which are directly accessible by the member function Display() of class STORE.
3. Write the names of all the member functions, which are directly accessible by the object ST of class STORE in main().
4. Write the statement to call and execute Display() function of class GM by the object ST declared in the main() function.

OR

**2(d).** Consider the following class Company :

```
class COMPANY
{
    int CCODE;
    char DES[20];
protected:
    char LOCATION[40];
public:
    void Register()
{cin>>CCODE;gets(DES);gets(LOCATION);}
    void Show()
{cout<<CCODE<<DES<<CITY<<endl;}
};
```

Write a code in C++ to privately derive another class TRADER from the base class COMPANY with the following members.

Data Members (private)

- STATE of type string
- TARGET of type float

Member Functions (public)

- A constructor function to assign STATE as "SOMESTATE" and TARGET as 1000.
- TraderReg() to allow user to enter STATE and TARGET, also call Register() of COMPANY.
- ShowTrade() to display STATE and TARGET.

**3(a).** Write the definition of a function SWAPPER(int M[], int N) in C++, which should SWAP alternate elements of the array M[] containing N number of integers, where N is an even integer. The function should also display the swapped content of the array.

Example : If the array M contains

|    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|
| 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| 18 | 13 | 12 | 17 | 16 | 21 | 14 | 15 |

Then the function should display the output as follows :

13  
18  
17  
12  
21  
16  
15  
14

OR

**3(a).** Write the definition of a function FourQtr(int A[], int N) in C++, which should display the sum of four quarters of the array A[] containing N number of integers, where N is an even integer.

Example : If the array A contains the following elements for N=8

|    |    |    |    |    |    |   |   |
|----|----|----|----|----|----|---|---|
| 0  | 1  | 2  | 3  | 4  | 5  | 6 | 7 |
| 70 | 30 | 20 | 10 | 60 | 50 | 5 | 7 |

Then the function should display

100  
30  
110  
12

**3(b).** Write the definition for a function TOPDIAG(int T[4][4]) in C++, which displays the portion content of the 2D array as displayed in the example below.

For example :

ARRAY T

|    |    |    |    |
|----|----|----|----|
| 12 | 14 | 16 | 18 |
| 10 | 11 | 13 | 15 |
| 22 | 24 | 26 | 28 |
| 20 | 21 | 23 | 25 |

CONTENT TO BE DISPLAYED

12 14 16 18  
10 11 13  
22 24  
20

OR

**3(b).** Write the definition for a function DiagSum(int P[4][4]) in C++, which finds and displays the sum of values on both the diagonal elements separately.

For example :

ARRAY P

|    |    |    |    |
|----|----|----|----|
| 20 | 15 | 25 | 50 |
| 35 | 30 | 40 | 15 |
| 55 | 50 | 60 | 45 |
| 70 | 75 | 85 | 80 |

OUTPUT

Sum of Diagonal 1:190  
Sum of Diagonal 2:210

**3(c).** Let us assume S[15][25] is a two-dimensional array, which is stored in the memory along the column with each of its element occupying 4 bytes, find the address of the element S[5][15], if the address of the element S[2][5] is 15000.

OR

**3(c).** If  $K[2...10][-2...20]$  is a two-dimensional array, which is stored in the memory along the row with a base address as 52000 and each of its element occupying 2 bytes, find the address of the element  $K[5][10]$ .

**3(d).** Write the definition of a function  $QInsert(float Q[], int \&R, int F)$ , which inserts a value in a circular static queue  $Q[]$  (here, consider parameters  $R$  as rear end of the queue and  $F$  as front end of the Queue). Also, check for a condition if the queue is full or not before performing insertion, the function should display a message "Queue is FULL" when the Queue is full.

OR

**3(d).** For the following structure of ITEM in C++

```
struct ITEM
{
    int    ID;
    char   Qty;
    ITEM *Next;
};
```

Given that the following declaration of class ITEMQUEUE in C++, which is representing a dynamic queue of ITEM (as per the structure ITEM declared above) :

```
class ITEMQUEUE
{
    ITEM *R, *F; //Pointers with addresses
    of Rear and Front
public:
    ITEMQUEUE()
    {
        R=NULL; F=NULL;
    }
    //A Function to insert an Item in the
    dynamic queue
    void QINSERT();
    //A Function to delete an Item from
    the dynamic queue
    void QDELETE();
    ~ITEMQUEUE();
};
```

Write the definition for the member function  $void ITEMQUEUE::QINSERT()$ , that will insert an item into the dynamic queue of ITEMQUEUE (take necessary input from user).

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

350,5,/,19,2,\*,20,-,-

OR

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

$U - V / W * R + T$

**4(a).** A text file named PRAYER.TXT contains some text. Write a function definition  $GODLINES()$  in C++ that would read each line of PRAYER.TXT and display those lines, which are starting with GOD.

OR

**4(a).** A text file named NOTES.TXT contains some text. Write the function definition  $DISPLAY2()$  in C++ which displays first 2 letters of each word of the text file.

For example : If the file NOTES.TXT contains :

PYTHON IS ONE LANGUAGE AND C++ IS ANOTHER LANGUAGE

Then the function should display the output as :

PY IS ON LA AN C+ IS AN LA

**4(b).** Write a definition for function NORTHTRADE() in C++ to read each object of a binary file TRADER.DAT, find and display the Total amount of trade done by traders from NORTH region.

Assume that the file TRADER.DAT is created with the help of objects of class Trader, which is defined below :

```
class Trader
{
    int Code; char Region[20]; float
    Amount;
public:
    void RegTrader();
    void ShowTrader();
    float GetAmount() { return Amount; }
    char* GetRegion() { return Region; }
};
```

OR

**4(b).** A binary file SWEETS.DAT contains records stored as objects of the following class :

```
class Sweet
{
    int SCode; char Sweet[20]; int Qty;
public:
    int GetSCode(){ return Scode; }
    int GetQty(){ return Qty; }
    void Show()
    { cout<<SCode<<" : "<<Sweet<<" : "
    <<Qty<<endl;
    };
};
```

Write definition for function ShowHigh() in C++, which displays the details of those sweets from the file SWEETS.DAT, whose Qty is more than 1000.

**4(c).** Find the output of the following C++ code considering that the binary file CHANNEL.DAT exists on the hard disk with the following 6 records for the class CHANNEL containing CNAME and TO (TURNOVER in Crore).

| CNAME        | TURNOVER |
|--------------|----------|
| KIDIES       | 11       |
| NEWSFAST     | 60       |
| QUICKNEWS    | 20       |
| CARTOONX     | 45       |
| GAMEZ        | 50       |
| MOVIETRACKER | 62       |

```
class CHANNEL
{
    char CNAME[20]; int T0;
public:
    void GetC();
    void ShowC()
    { cout<<CNAME<<" : "
    <<T0<<endl; }
};
```

```
void main()
{ fstream F;

F.open("CHANNEL.DAT", ios::binary | ios::in);
CHANNEL C;
F.seekg(3*sizeof(C));
F.read((char*)&C, sizeof(C));
F.read((char*)&C, sizeof(C));
C.ShowC();
F.close();
}
```

OR

**4(c).** Differentiate between seekp() and tellp(). Give a suitable example to illustrate the difference.

## Section C — Common Questions

**5(a).** Observe the following table FOOD carefully and answer the questions that follow :

TABLE:FOOD

| AVGPRICE | FNAME          | FNO | ORIGIN      |
|----------|----------------|-----|-------------|
| 75       | DOSA           | F01 | SOUTH INDIA |
| 100      | BURGER         | F03 | AMERICAN    |
| 45       | VADA PAV       | F04 | MAHARASHTRA |
| 70       | CHOW MEIN      | F09 | CHINA       |
| 70       | CHOLE BHATURE  | F15 | PUNJAB      |
| 80       | SARSON KA SAAG | F12 | RAJASTHAN   |
| 25       | MAKKI KI ROTI  | F11 | RAJASTHAN   |

1. What is the Degree and Cardinality of table FOOD ?
2. Which attribute out of AVGPRICE, FNAME, FNO and ORIGIN of table FOOD is the ideal one for being considered as the Primary Key and why ?

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

TABLE:FURNITURE

| FNO | FNAME          | MATERIAL | QTY | SUPID |
|-----|----------------|----------|-----|-------|
| F01 | CLASSIC BED    | WOOD     | 12  | S01   |
| F02 | SOFT SOFA      | LEATHER  | 50  | S05   |
| F03 | SHAHI BED      | METAL    | 5   | S06   |
| F09 | TERRACE CHAIR  | PLASTIC  | 120 | S04   |
| F12 | CLASSIC CHAIR  | WOOD     | 300 | S02   |
| F11 | DINING TABLE   | WOOD     | 45  | S01   |
| F23 | SIDE TABLE     | GLASS    | 200 | S02   |
| F15 | DINING CHAIR   | WOOD     | 300 | S01   |
| F19 | RELAXER        | LEATHER  | 50  | S05   |
| F04 | BUSINESS CHAIR | METAL    | 450 | S06   |

TABLE:SUPPLIER

**5(b).** (continued)

| SUPID | SNAME          | TURNOVER | CONTACT    |
|-------|----------------|----------|------------|
| S01   | WOOD FINISHERS | 5600000  | P K MANTRA |
| S02   | SHINE N CUT    | 12000000 | F SAHOO    |
| S04   | PLASTINA TECH  | 32000000 | T CHANDRA  |
| S05   | SOFTELIA       | 56000000 | S JOHN     |
| S06   | SOLID METALS   | 45000000 | P C KATKAR |

**5(b).** (continued)

1. To display details of all the furniture from table FURNITURE, which are either GLASS or LEATHER material.
2. To display the FNO, FNAME, QTY of those furnitures from table FURNITURE, whose QTY is more than 100.
3. To count number of suppliers from table SUPPLIER, whose TURNOVER is more than 25000000.
4. To display details of all furniture from table FURNITURE in descending order of FNO.
5. SELECT MAX(TURNOVER), MIN(TURNOVER) FROM SUPPLIER;
6. SELECT SUM(QTY), MATERIAL FROM FURNITURE GROUP BY MATERIAL HAVING COUNT(\*) > 2;
7. SELECT DISTINCT MATERIAL FROM FURNITURE;
8. SELECT FNAME, SNAME FROM FURNITURE F, SUPPLIER S WHERE F.SUPID = S.SUPID AND QTY=300;

**6(a).** State any one De Morgan's Law of Boolean Algebra and verify it using truth table.

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

$$A' \cdot (B' + C) + D'$$

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

| P | Q | R | F(P,Q,R) |
|---|---|---|----------|
| 0 | 0 | 0 | 1        |
| 0 | 0 | 1 | 1        |
| 0 | 1 | 0 | 0        |
| 0 | 1 | 1 | 1        |
| 1 | 0 | 0 | 0        |
| 1 | 0 | 1 | 0        |
| 1 | 1 | 0 | 1        |
| 1 | 1 | 1 | 0        |

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

$$F(U,V,W,Z) = \Sigma(0,2,4,5,8,10,11,13,14,15)$$

**7(a).** Ms. Taruna Gehlot copied a file from her friend's PEN DRIVE on to her Laptop and when she opened the file, her Laptop functions slowed down and other applications on the Laptop stopped working properly. Specifically, which of the following could have infected her Laptop files and Operating System out of the following ? Also, mention, what she should do to remove this infection from her Laptop ?

- (A) Spam Email (B) Worm  
(C) Virus (D) Trojan Horse

**7(b).** Mr. Priyaver Desai was travelling from Mumbai to Delhi for his vacation along with his brand new Laptop (with no data and software installed in it) and one brand new portable hard drive. These items, he had bought for gifting to his nephew in Delhi. While travelling in the train, a co-traveller ran away with both these items. Do you think Mr. Desai should report this as a Cyber Crime or any other crime ? Write the reason for your answer.

**7(c).** Give two differences between Video Conferencing and Text Chat service.

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

1. SMTP
2. GSM
3. TCP
4. PPP

### 7(e). Case Study Based Question

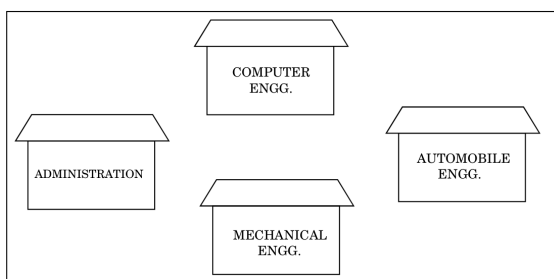
Global Knowledge Share Institute is planning to set up its centre in Hyderabad with four specialised blocks for Computer Engineering, Mechanical Engineering, Automobile Engineering along with Administration blocks in four separate buildings. The physical distances between these blocks and the number of computers to be installed in these blocks are given below. You as a network expert have to answer the queries (i) to (iv) as raised by the financial advisers of the institution.

Shortest distances between various locations in metres are as follows :

|                                             |     |
|---------------------------------------------|-----|
| Computer Engg. to Mechanical Engg. Blocks   | 60  |
| Computer Engg. to Automobile Engg. Blocks   | 40  |
| Computer Engg. to Administration Blocks     | 60  |
| Automobile Engg. to Mechanical Engg. Blocks | 50  |
| Automobile Engg. to Administration Blocks   | 110 |
| Mechanical Engg. to Administration Blocks   | 40  |

Number of computers installed at various locations are as follows :

|                        |     |
|------------------------|-----|
| Administration Block   | 20  |
| Computer Engg. Block   | 170 |
| Mechanical Engg. Block | 50  |
| Automobile Engg. Block | 40  |



**7(e)(i).** Suggest the most suitable location to install the main server of Global Knowledge Share Institute to get efficient connectivity with all the blocks.

**7(e)(ii).** Suggest with the help of a drawing the best cable layout for effective network connectivity between all the blocks.

**7(e)(iii).** Out of the following, suggest the most suitable device to be installed in each of these blocks for connecting all the computers installed within the centre :

- |             |            |
|-------------|------------|
| (A) Modem   | (B) Switch |
| (C) Gateway | (D) Router |

**7(e)(iv).** Out of the following, suggest the most suitable wired medium for efficiently connecting the blocks :

Also, mention which Topology of network, will be formed by connecting all the computer systems within each centre :

Bus Topology or Star Topology

- |                    |                                 |
|--------------------|---------------------------------|
| (A) Optical Fiber  | (B) Ethernet Cable              |
| (C) Co-axial Cable | (D) Single Pair Telephone Cable |

- End of Question Paper -