

COMPUTER SCIENCE : YEAR 2009 Type

SOLVED

Time Allowed: 3 hours

Maximum Marks: 70

Instructions:

(i) All Questions are compulsory.

(ii) Programming Language: C++

1. (a) What is the difference between #define and const? Explain with suitable example.

While they both serve a similar purpose, **#define** and **const** act differently. When using **#define** the identifier gets replaced by the specified value by the compiler, before the code is turned into binary. This means that the compiler makes the substitution when you compile the application.

As an example to define the above:

```
#define number 108
```

In this case every instance of “number” will be replaced by the actual number 108 in your code, and this means the final compiled program will have the number 108 (in binary).

On the other hand, when we use **const** and the application runs, memory is allocated for the constant and the value gets replaced when the application is ran:

```
const int number = 108;
```

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(b) Name the header files that shall be needed for the following code

```
void main( )
```

```

{
    char String[ ] = "Peace";
    cout<<setw(20)<<String;
}

```

iomanip.h
iostream.h

(c) Rewrite the following program after removing the syntactical error(s) if any. Underline each correction.

```

#include<iostream.h>
void main( )
{
    First = 10, Second = 20;
    Jumpto(First; Second);
    Jumpto(Second);
}
void Jumpto(int N1, int N2=20)
{
    N1 = N1 + N2;
    cout<<N1>>N2;
}

```

Solution:

```

#include<iostream.h>
void main( )
{
int First =10, Second = 20; // data type missing
Jumpto(First, Second); // comma to come instead of ;
    Jumpto(Second);
}
void Jumpto(int N1, int N2=20)
{
    N1 = N1 + N2;
cout<<N1<<N2; // Output operator << required
}

```

(d) Find the output of the following program:

```

#include<iostream.h>

```

```

#include<ctype.h>
void main( )
{
    char Text[ ] = "Mind@Work!";
    for (int I=0;Text(I)!='\0';I++)
    {
        if (!isalpha(Text[I])
            Text[I]='*';
        else if (isupper(Text[I])
            Text[I] = Text[I] + 1;
        else
            Text(I) = Text[I+1];
    }
    cout<<Text;
}

```

SAMPLE OUTPUT:

Nnd@*Xrk!*

(e) Find the output of the following program:

```

#include<iostream.h>
void main( )
{
    int U = 10, V = 20;
    for (int I = 1; I<=2; I++)
    {
        cout<<"[1]="<<U++<<"&"<<V-5<<endl;
        cout<<"[2]="<<V++<<"&"<<U+2<<endl;
    }
}

```

SAMPLE OUTPUT:

```

[1]=10&15
[2]=20&13
[1]=11&16
[2]=21&14

```

(f) In the following program, find the correct possible output(s) from the options:

```
#include<stdlib.h>
#include<iostream.h>
void main( )
{
    randomize( );
    char City[ ][10] = {"DEL", "CHN", "KOL", "BOM", "BNG"};
    int Fly;
    for(int I=0;I<3;I++)
    {
        Fly = random(2)+1;
        cout<<City[Fly]<<":";
    }
}
```

outputs:

(i) DEL:CHN: KOL:

(ii) CHN:KOL:CHN:

(iii) KOL:BON:BNG

(iv) KOL: CHN: KOL

OUTPUT :

KOL:CHN:KOL:

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2. (a) Differentiate between **public** and **private** visibility modes in context of Object Oriented Programming using a suitable example illustrating each.

public visibility label is used to define any method or a variable which may be accessed by any member function of the same class and also from outside the class.

private visibility mode is used to make any variable or a method which has a limited access within the class only.

The concept of data hiding is implemented through the private visibility mode only.

Example:

```
Class student
{
private:
char name[10];
int age;
public:
void input( );
void display( );
};
```

Here the two variables name and age are private and they can not be accessed outside the class whereas the functions/ methods may be used outside the class through objects. The private items of any class may be implemented or called from their member methods in any case.

(b) Answer the question (i) and (ii) after going through the following program:

```
#include<iostream.h>
#include<string.h>
class Bazar
{
char Type[20];
char Product[20];
int Qty;
float Price;
Bazar( )          // Function 1
{
    strcpy(Type, "Electronic");
    strcpy(Product, "Calculator");
    Qty =10;
    Price = 225;
}
```

public:

```
void Disp( ) // Function 2
{
    cout<<Type<<"-"<<Product<<":"<<Qty<<"@"<<Price<<endl;
}
};
void main( )
{
    Bazar B; // Statement 1
    B.Disp( ); // Statement 2
}
```

(i) Will Statement 1 initialize all the data members for object B with the values given in the Function 1? (Yes OR No). Justify your answer suggesting the correction(s) to be made in the above code.

NO. The reason is the constructor should be defined under the public visibility label.

(ii) What shall be the possible output when the program gets executed? (Assuming, if required- the suggested correction(s) are made in the program).

SAMPLE OUTPUT:

Electronic-Calculator:10@225

(c) Define a class **Garments** in C++ with the following descriptions:

Private Members:

GCode	of type string
GType	of type string
GSize	of type integer
GFabric	of type string
GPrice	of type float

A function Assign() which calculates and assigns the value of GPrice as follows

For the value of GFabric as "COTTON",

GType	GPrice(Rs)
TROUSER	1300
SHIRT	1100

For GFabric other than "COTTON" the above mentioned GPRICE gets reduced by 10%

Public Members:

A Constructor to assign initial values of GCode, GType and GFabric with the word "NOT ALLOTTED" and GSize and GPrice with 0

A function Input() to input the values of the data members GCode, GType, GSize and GFabric1 and invoke the Assign() function. A function Display() which displays the content of all the data members for a Garment.

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Solution:

```
#include<iostream.h>
#include<string.h>
class Garments
{
private:

    char gcode[20];
    char gtype[20];
    int gsize;
    char gfabric[20];
    float gprice;
public:
    Garments()          // Constructor
    {
        strcpy(gcode, "Not Allotted");
        strcpy(gtype, "Not Allotted");
        gsize=0;
        strcpy(gfabric, "Not Allotted");
        float gprice=0;
    }
public:
void assign()
```

```

{
if (strcmp(gfabric, "COTTON")==0)
{
    if (strcmp(gtype, "SHIRT")== 0)
        gprice = 1100;
    if (strcmp(gtype, "TROUSER")==0)
        gprice = 1300;
}

else

gprice= gprice - (10/100)* gprice;
}

void display()
{
cout<<gcode;
    cout<<gtype;
    cout<<gsize;
    cout<<gfabric;
    cout<<gprice;
}

        void input( )
        {
            cin>>gcode;

            cin>>gtype;
            cin>>gsize;
            cin>>gfabric;
            assign();
        }
};

```

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

```

class Dolls
{
    char DCode[5];
protected:
    float Price;
    void CaclPrice(float);
public:

```

```

        Dolls( );
        void DInput( );
        void DShow( );
};
class SoftDolls:public Dolls
{
    char SDName[20];
    float Weight;
public:
    SoftDolls( );
    void SDInput( );
    void SDSHOW( );
};
class ElectronicDolls: public Dolls
{
    char EDName[20];
    char BatteryType[10];
    int Batteries;
public:
    ElectronicDolls( );
    void EDInput( );
    void EDSHOW( );
};

```

(i) Which type of Inheritance is shown in the above example?

Hierarchical Inheritance. Since the subclasses are derived from a single base class (Dolls).

(ii) How many bytes will be required by an object of the class ElectronicDolls?

Class Electronic Dolls has the following data types:

```

char EDName[20]
char BatteryType[20]
int Batteries
float Price; // of class Dolls as it is defined as protected.

```

Data Storage:

```

char: 1 byte * 20 = 20 // of the variable EDName
char: 1 byte * 20 = 20 // of the variable BatteryType
int: 2 bytes * 1 = 2 // of the variable Batteries
float: 4 bytes * 1 = 4 // of the variable Price

```

= 46

Keeping the fact in view that char takes 1 byte of storage, int takes 2 bytes and float takes 4 bytes accordingly.

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(iii) Write name of all the data members accessible from member functions of the class SoftDolls.

Price
SDName
Weight

(iv) Write name of all the member functions accessible by an object of the class ElectronicDolls.

DInput()
DShow()
ElectronicDolls()
EDInput()
EDShow()

3. (a) Write a function in C++, which accepts an integer array and its size as parameters and rearranges the array in reverse. Example: if an array of nine elements initially contains the elements as
4, 2, 5, 1, 6, 7, 8, 12, 10

then the function should rearrange the array as

10, 12, 8, 7, 6, 1, 5, 2, 4

Solution:

```
#include<iostream.h>
#include<string.h>
```

```

#include<conio.h>
void reverse(int arr[],int s)
{
for(int i=s-1;i>=0;i--)
cout<<arr[i]<<endl;
}

void main()
{
int num;
cin>>num;
int array[100];
for(int i=0;i<num;i++)
cin>>array[i];
cout<<"Call of function"<<endl;
reverse(array,num);
getch();
}

```

SAMPLE EXECUTION:

Input:

5

1

2

3

4

5

Output:

Call of function

5

4

3

2

1

(b) An array Arr[40][10] is stored in the memory along the column with each element occupying 4 bytes. Find out the address of the location Arr[3][6] if the location Arr[30][10] is stored at the address 9000.

Address[i][j] = B + W (n* j + i)

where B is the base address, W is the size of the element and n is the number of rows.

Given:

$$W = 4$$

$$B = ?$$

$$i = 30$$

$$j = 10$$

$$n = 40$$

$$\text{Address}[i][j] = 9000$$

$$9000 = B + 4 (40 * 10 + 30)$$

$$9000 = B + 4 (400 + 30)$$

$$9000 = B + 430 * 4 = B + 1720$$

$$B = 9000 - 1720$$

$$= 7280$$

Now when the Base Address (B) = 7280

$$\text{Address}[3][6] = 7280 + 4 (40 * 6 + 3)$$

$$= 7280 + 4 * 243$$

$$= 8252 \text{ (Answer)}$$

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(c) Write a function in C++ to insert an element into a dynamically allocated Queue where each node contains a name (of type string) as data.

Assume the following definition of THENODE for the same:

```
struct THENODE
```

```
{
    char Name[20];
    THENODE *Link;
};
```

Solution: (Full Program)

```
#include<iostream.h>
#include<conio.h>
#include<string.h>
struct THENODE
{
    char Name[20];
    THENODE *Link;
}*FRONT,*REAR;
void insert(THENODE *ptr)
{
    THENODE *NODE;
    NODE =new THENODE;
    strcpy(NODE->Name,ptr->Name);
    NODE->Link=NULL;

    if(FRONT==NULL)
    {
        FRONT=NODE;
        REAR=NODE;
    }
    else
    {
        REAR->Link=NODE;
        REAR=NODE;
    }
}
void display()
{
    THENODE *START;
    for(START=FRONT;START!=NULL;START=START->Link)
        cout<<START->Name<<" ";
}

void main()
{
    THENODE *ptr;
    ptr=new THENODE;
```

```

for(int i=1;i<=3;i++)
{
cin>>ptr->Name;
insert(ptr);
}
display();
getch();
}

```

(d) Write a function in C++ to print the product of each column of a two dimensional integer array passed as the argument of the function.

Explain: if the two dimensional array contains

1	2	4
3	5	6
4	3	2
2	1	5

Then the output should appear as:

Product of Column1 = 24
Product of Column2 = 30
Product of Column3 = 240

Solution:

```

#include<iostream.h>
#include<string.h>
#include<conio.h>
void product(int arr[[[
{
int ps=1;
for(int i=0;i<3;i++)
{
for(int j=0; j<3;j++)

{
ps = ps*arr[i][j];
}

cout<<"The product of the column "<<i+1<<" is "<<ps;
ps=1;
}

```

```

void main()
{
int array[3][3];
for(int i=0;i<3;i++)
{
for(int j=0; j<3;j++)

{
cin>>array[i][j];

}
cout<<endl;
cout<<"Call of function"<<endl;
product(array)
getch();
}

```

Sample Execution:

INPUT:

1
2
3
4
5
6
7
8
9

OUTPUT:

Call of function

The product of the column 1 is 6
The product of the column 2 is 120
The product of the column 3 is 504

(e) Evaluate the following postfix notation of expression (Show status of Stack after execution of each operation):

4, 10, 5, +, *, 15, 3, /, -

Final Answer:

55

Considering the concept of with each operator, two operands popped and the operation is performed.

4. (a) Observe the program segment given below carefully, and answer the question that follows:

```
class Applicant
{
long Ald;      // Applicant's ID
char name[20]; // Applicant's Name
float Score;   // Applicant's Score
public:
void Enroll( );
void Disp( );
void MarksScore( ); // Function to change Score
longR_Ald( ) { return Ald;}
};
void ScoreUpdate(long Id)
{
fstream File;
File.open("Appli.dat", ios::binary|ios::in|ios::out);
Applicant A;
int Record = 0, Found = 0;
while (!Found && File.read((char*) &C, sizeof(c)))
{
if (Id==A.R_Ald( ))
{
cout<<"Enter new Score";
A.MarksScore( );
_____ // Statement1
_____ // Statement2
Found=1;
}
Record++;
}
if (Found ==1) cout<<"Record Updated";
File.close( );
}
```

Write the statement to position the File Pointer at the beginning of the Record for which the Applicant's Id matches with the argument passed, and statement2 to write the updated Record at that position.

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Solution:

Statement1:

```
file.seekg(record);
```

Statement2:

```
file.write(char *) &A, Sizeof(A);
```

(b) Write a function in C++ to count the number of lowercase alphabets present in an text file "BOOK.TXT".

hint:

islower(); function.

(c) Given a binary file PHONE.DAT, containing records of the following structure type:

```
class Phonlist
{
    char Name[20];
    char Address[30];
    char AreaCode[5];
    char PhoneNo[15];
public:
    void Register( );
    void Show( );
    int CheckCode(char AC[ ])
    {
        return strcmp(AreaCode, AC);
    }
};
```

Write a function TRANSFER() in C++, that would copy all those records which are having AreaCode as "DEL" from PHONE.DAT to PHONBACK.DAT

Solution:

```
void transfer( )
{
ofstream phonelist A;
file2("phonebook.dat");
ifstream file1(k"phone.dat");
while(!file1.eof())
{
    file.read((char*)&A, sizeof(A));
    if (strcmp(A.areacode,"Del")==0)
        file2.write((char*)&A, sizeof(A));
}

file1.close( );
file2.close( );
}
```

5. (a) Differentiate between Candidate Key and Primary Key in context of RDBMS.

A Primary Key is a set of one or more attributes that can uniquely identify tuples within the relation.

Candidate keys are the attribute combinations inside a relation that can serve as a Primary key being the candidates of the primary key accordingly.

(b) Consider the following tables Product and Client. Write SQL commands for the statement (i) to (iv) and give outputs for SQL queries (v) to (viii)

TABLE: PRODUCT

P_ID	ProductName	Manufacturer	Price
TP01	Talcom Powder	LAK	40
FW05	Face Wash	ABC	45
BS01	Bath Soap	ABC	55
SH06	Shampoo	XYZ	120
FW12	Face Wash	XYZ	95

TABLE: CLIENT

C_ID	ClientName	City	P_ID
------	------------	------	------

01	Cosmetic Shop	Delhi	FW05
06	Total Health	Mumbai	BS01
12	Live Life	Delhi	SH06
15	Pretty Woman	Delhi	FW12
16	Dreams	Bangalore	TP01

(i) To display the details of those Clients whose City is Delhi.

```
Rdks`kqnl Bktns v gdl Bks <=Cdlgh
```

(ii) To display the details of Products whose Price is in the range of 50 to 100 (Both values included)

```
Rdks`kqnl Oqct bsr v gdl Oqbd =<4/ @MC Oqbd ; <0// :
```

(iii) To display the ClientName, City from table Client, and ProductName and Price from table Product, with their corresponding matching P_ID

Hint: Select Fieldname From Table where <condition>

(iv) To increase the Price of all Products by 10

```
UPDATE Product Set Price = Price + 10;
```

(v) SELECT DISTINCT Address FROM Client;

Shall display the records ensuring that multiple entries of the same address FROM Client are ignored.

(vi) SELECT Manufacturer, MAX(Price), Min(Price), Count(*) FROM Product GROUP BY Manufacturer;

120

40

Details of the Product table with details accordingly.

(vii) SELECT ClientName, ManufacturerName FROM Product, Client WHERE Client.Prod_Id= Product.P_Id;

```
Dreams LAK
Cosmetic Shop ABC
Total Health ABC
Live Life XYZ
```

Pretty Woman XYZ

(viii). SELECT ProductName, Price*4 FROM Product

Talcom Powder 160
 Face Wash 180
 Bath Soap 220
 Shampoo 480
 Face Wash 380

6. (a) State and verify De Morgan's Law in Boolean Algebra.

$(A+B)' = A'B'$
 $(A \cdot B)' = A' + B'$

A	B	A+B	(A+B)'	A'	B'	A'B'
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

(b) Draw a Logical Circuit Diagram for the following Boolean Expression

$$X' \cdot (Y' + Z)$$

(c) Convert the following Boolean expression into its equivalent Canonical Sum of Product Form (SOP)

$$(X' + Y + Z') \cdot (X' + Y + Z) \cdot (X' + Y' + Z) \cdot (X' + Y' + Z')$$

DECIMAL EQUIVALENT	X	Y	Z	MAXTERM	MINTERM
0	0	0	0	X+Y+Z	X'.Y'.Z'
1	0	0	1	X+Y+Z'	X'.Y'.Z
2	0	1	0	X+Y'+Z	X'.Y.Z'
3	0	1	1	X+Y'+Z'	X'.Y.Z
4	1	0	0	X'+Y+Z	X.Y'.Z'
5	1	0	1	X'+Y+Z'	X.Y'.Z
6	1	1	0	X'+Y'+Z	X.Y.Z'
7	1	1	1	X'+Y'+Z'	X.Y.Z

(4,5,6,7) is given, hence the SOP shall be written for the terms $\Sigma (0,1,2,3)$.

Answer: ==>

$$X'.Y'.Z' + X'.Y'.Z + X'.Y.Z' + X'.Y.Z$$

(d) Reduce the following Boolean Expression using K-Map

$$F(A, B, C, D) = (0,2,3,4,6,7,8,10,12)$$

For Solution:

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Considering the above K-map we get the following:

$$\text{Quad 1 (0,4,12,8)} \implies C'.D'$$

$$\text{Quad 2 (3,2,6,7)} \implies A'.C$$

$$\text{Pair (10, 2)} \implies B'.C.D'$$

Hence the reduced expression is :

$$C'.D' + A'.C + B'.C.D'$$

7. (a) What is Hub?

A HUB is a hardware device that is used to connect several computers together to share data and resources.

(b) Expand the following terms with respect to Networking:

(i) MODEM: Modulator Demodulator

(ii) WLL: Wireless Local Loop

(iii) FTP: File Transfer Protocol

(iv) TCP/ IP: Transmission Control Protocol/ Internet Protocol

(c) How is Coaxial Cable different from Optical Fibre?

A Coaxial Cable consists of a solid wire core surrounded by one or more foil or wire shields, each separated by some kind of a plastic insulator.

Whereas an Optical Fibre consists of a thin strands of glass or a glass like material which are so constructed that they carry light from a source at one end of the fiber to a detector at the other end.

(d) “Bias Methodologies” is planning to expand their network in India, starting with three cities in India to build infrastructure for research and development of their chemical products. The company has planned to setup their main office in Pondicherry- at three different locations and have named their offices as “Back Office”, “Research lab” and “Development Unit”. The company has one more Research office namely “Corporate Office” in “Mumbai”. A rough layout of the same is as follows:

Approximate distances between these offices is as follows:

FROM	TO	DISTANCE
Research Lab	Back Office	110 Mts
Research Lab	Development Unit	16 KM
Research Lab	Corporate Unit	1800 KM
Back Office	Development Unit	13 KM

In continuation of the above, the company experts have planned to install the following number of computers in each of their offices:

Research Lab	158
Back Office	79
Development Unit	90
Corporate Unit	51

(i) Suggest the kind of network (out of LAN, MAN, WAN) for connecting each of the following office units:

Research Lab and Back Office

LAN

LAN

Research Lab and Development Unit

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(ii) Which one of the following device will you suggest for connecting all the computers with in each of their office units?

Switch/ Hub

Modem

Telephone

Switch/ Hub

(iii) Which of the following communication medium, you will suggest to be procured by the company for connecting their local office units in Pondicherry for very effective (High Speed) Communication?

Telephone Cable

Optical Fiber

Ethernet Cable

(iv) Suggest a cable/ wiring layout for connecting the company's local office units located in Pondicherry. Also suggest an effective method/ technology for connecting the company's office unit located in Mumbai.

Wireless/ LAN

WAN

For the Building within the office: LAN with clients computers, Server, Hub, Cabling and the NOS (Network Operating System).

For Mumbai Office and Pondicherry Offices: Clients, Servers, Hubs, Switches, Routers at each location for WAN connections, Cabling, WAN Service, NOS (Network Operating System software).