M.Sc. (Five Year Integrated) in Computer Science (Artificial Intelligence & Data Science)

First Semester

Laboratory Record

21-805-0107: C++ PROGRAMMING LAB

Submitted in partial fulfillment
of the requirements for the award of degree in
Master of Science (Five Year Integrated)
in Computer Science (Artificial Intelligence & Data Science) of
Cochin University of Science and Technology (CUSAT)
Kochi

Submitted by

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KOCHI-682022

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DEPARTMENT OF COMPUTER SCIENCE

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY (CUSAT)

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This is to certify that the software laboratory record for ***21-805-0107: C++ Programming Lab*** *is a record of work carried out by* ***NOBLE AUSTINE (80521014)****, in partial fulfillment of the requirements for the award of degree in* ***Master of Science (Five Year Integrated)*** *in* ***Computer Science (Artificial Intelligence & Data Science)*** *of Cochin University of Science and Technology (CUSAT), Kochi. The lab record has been approved as it satisfies the academic requirements in respect of the first semester laboratory prescribed for the Master of Science (Five Year Integrated) in Computer Science degree.*

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STUDENT GRADES

AIM

To calculate the grades of a list of students with attributes(Name, Roll_no, Marks of 3 subjects) using class with member functions input(), calcGrade(), display()

PROGRAM

```
#include <iostream>
#include <cstring>

using namespace std;

class student
{
    string name;
    char grade;
    int roll_no;
    double m_oop,m_ct4ps,m_maths,avg;

public:
    void input();
    char calc_grade();
    void display();
};

void student::input()
{
    cout<<" Enter the name of the student       : ";
    cin>>name;

    cout<<" Enter the roll no. of the student   : ";
    cin>>roll_no;

    cout<<" Enter the marks in oop out of 100   : ";
    cin>>m_oop;
    while(m_oop>100||m_oop<0)
    {
        cout<<"  "<<endl;
        cout<<"------------ Invalid entry ------------"<<endl;
        cout<<"  "<<endl;
```

```
        cout<<" Enter the marks in oop out of 100   : ";
        cin>>m_oop;
    }

    cout<<" Enter the marks in ct4ps out of 100 : ";
    cin>>m_ct4ps;
    while(m_ct4ps>100||m_ct4ps<0)
    {
        cout<<"  "<<endl;
        cout<<"------------ Invalid entry ------------"<<endl;
        cout<<"  "<<endl;
        cout<<" Enter the marks in ct4ps out of 100 : ";
        cin>>m_ct4ps;
    }

    cout<<" Enter the marks in maths out of 100 : ";
    cin>>m_maths;
    while(m_maths>100||m_maths<0)
    {
        cout<<"  "<<endl;
        cout<<"------------ Invalid entry ------------"<<endl;
        cout<<"  "<<endl;
        cout<<" Enter the marks in maths out of 100 : ";
        cin>>m_maths;
    }
}

char student::calc_grade()
{
    avg = (m_oop + m_ct4ps + m_maths)/3;

    if (100>=avg&&avg>90)
    {
        grade='A';
    }
    else if(90>=avg&&avg>80)
    {
        grade='B';
    }
    else if(80>=avg&&avg>70)
    {
```

```
        grade='C';
    }
    else if(70>=avg&&avg>60)
    {
        grade='D';
    }
    else if(60>=avg&&avg>50)
    {
        grade='E';
    }
    else
    {
         grade='F';
    }

    return grade;
}

void student ::display()
{
    cout<<"| \t"<<name<<"\t\t |\t"<<roll_no<<"\t|\t"<<m_oop<<"\t|\t"<<m_ct4ps<<"\t|\t"
    <<m_maths<<"\t|\t"<<avg<<"\t  |   "<<grade<<"   |"<<endl;
}

int main()
{
    int n;
    cout<<"                    Program to print the mark list of N students "<<endl;
    cout<<"                  ------------------------------------------------"<<endl;
    cout<<" "<<endl;

    cout<<"  Enter the number of students : ";
    cin>>n;
    cout<<" "<<endl;
    student* mark_list;
    mark_list= new student[n];

    for(int i=0;i<n;i++)
    {
        cout<<"            DETAILS OF STUDENT:- "<<i+1<<endl;
        cout<<"-----------------------------------------------"<<endl;
```

```
        mark_list[i];
        mark_list[i].input();
        mark_list[i].calc_grade();
        cout<<"-----------------------------------------------"<<endl;
        cout<<" "<<endl;
    }

    cout<<"                                                    MARK LIST"<<endl;
    cout<<"                                                   ==========="<<endl;
    cout<<"+-------------------------------------------------------------------------
    ----------------------------------------+"<<endl;
    cout<<"|   NAME OF THE STUDENT  |    ROLL NO.  |  MARKS IN OOP |MARKS IN CT4PS |
    MARKS IN MATHS |  AVERAGE MARKS  | GRADE |"<<endl;
    cout<<"|------------------------|--------------|---------------|---------------|
    ---------------|-----------------|-------|"<<endl;
    for(int j=0;j<n;j++)
    {
        if(j==n-1)
        {
            mark_list[j].calc_grade();
            mark_list[j].display();
            cout<<"+-------------------------------------------------------------------
            ------------------------------------------------+"<<endl;
        }
        else
        {
            mark_list[j].calc_grade();
            mark_list[j].display();
            cout<<"|------------------------|--------------|---------------|---------
            ------|---------------|-----------------|-------|"<<endl;

        }
    }
    cout<<" "<<endl;
    cout<<"                                 ----------------- Thank You -------------
    ----"<<endl;
    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
                  Program to print the mark list of N students
                ------------------------------------------------

 Enter the number of students : 6

          DETAILS OF STUDENT:- 1
-----------------------------------------------
Enter the name of the student       : Abhin
Enter the roll no. of the student   : 1
Enter the marks in oop out of 100   : 77
Enter the marks in ct4ps out of 100 : 73
Enter the marks in maths out of 100 : 76
-----------------------------------------------

          DETAILS OF STUDENT:- 2
-----------------------------------------------
Enter the name of the student       : Arjun
Enter the roll no. of the student   : 2
Enter the marks in oop out of 100   : 56
Enter the marks in ct4ps out of 100 : 59
Enter the marks in maths out of 100 : 60
-----------------------------------------------

          DETAILS OF STUDENT:- 3
-----------------------------------------------
Enter the name of the student       : Diliya
Enter the roll no. of the student   : 3
Enter the marks in oop out of 100   : 98
Enter the marks in ct4ps out of 100 : 97
Enter the marks in maths out of 100 : 99
-----------------------------------------------

           DETAILS OF STUDENT:- 4
-----------------------------------------------
Enter the name of the student       : Febin
Enter the roll no. of the student   : 4
Enter the marks in oop out of 100   : 80
Enter the marks in ct4ps out of 100 : 84
Enter the marks in maths out of 100 : 89
-----------------------------------------------

           DETAILS OF STUDENT:- 5
-----------------------------------------------
Enter the name of the student       : Leya
Enter the roll no. of the student   : 5
Enter the marks in oop out of 100   : 63
Enter the marks in ct4ps out of 100 : 68
Enter the marks in maths out of 100 : 65
-----------------------------------------------

           DETAILS OF STUDENT:- 6
-----------------------------------------------
Enter the name of the student       : Sara
Enter the roll no. of the student   : 6
Enter the marks in oop out of 100   : 50
Enter the marks in ct4ps out of 100 : 45
Enter the marks in maths out of 100 : 43
-----------------------------------------------


                                      MARK LIST
                                     ===========
+-----------------------+-------------+---------------+---------------+---------------+-----------------+-------+
|  NAME OF THE STUDENT  |  ROLL NO.   | MARKS IN OOP  |MARKS IN CT4PS |MARKS IN MATHS |  AVERAGE MARKS  | GRADE |
|-----------------------|-------------|---------------|---------------|---------------|-----------------|-------|
|       Abhin           |      1      |       77      |       73      |       76      |       75.3333  |   C   |
|-----------------------|-------------|---------------|---------------|---------------|-----------------|-------|
|       Arjun           |      2      |       56      |       59      |       60      |       58.3333  |   E   |
|-----------------------|-------------|---------------|---------------|---------------|-----------------|-------|
|       Diliya          |      3      |       98      |       97      |       99      |       98        |   A   |
|-----------------------|-------------|---------------|---------------|---------------|-----------------|-------|
|       Febin           |      4      |       80      |       84      |       89      |       84.3333  |   B   |
|-----------------------|-------------|---------------|---------------|---------------|-----------------|-------|
|       Leya            |      5      |       63      |       68      |       65      |       65.3333  |   D   |
|-----------------------|-------------|---------------|---------------|---------------|-----------------|-------|
|       Sara            |      6      |       50      |       45      |       43      |       46        |   F   |
+-----------------------+-------------+---------------+---------------+---------------+-----------------+-------+

                          ----------------- Thank You -----------------
```

OVERLOADING FUNCTION TO FIND AREA

AIM

To calculate the area of different shapes like Rectangle, Square etc(at least 5 shapes) using overloaded function area()

PROGRAM

```
#include <iostream>
#include <cmath>

using namespace std;

string permission()
{
    string check;
    cout<<"          Do you want to continue ?"<<endl;
    cout<<"                   yes or no?       "<<endl;
    cout<<":--";
    cin>>check;
    if(check!="yes"&&check!="no")
    {
        cout<<" "<<endl;
        cout<<"------------ Invalid Entry -------------"<<endl;
        cout<<" "<<endl;
        cout<<"       Do you want to continue ?"<<endl;
        cout<<"                yes or no?       "<<endl;
        cout<<":--";
        cin>>check;
    }
    return check;
}

int area(int a)
{
   int ar=a*a;
   return ar;
}

int area(int a,int b)
{
```

```
   int ar=a*b;
   return ar;
}

int area(int a,int b,int c)
{
   int s=(a+b+c)/2;
   int ar2=s*(s-a)*(s-b)*(s-c);
   int ar=pow(ar2,0.5);
   return ar;
}

double area(double r)
{
   double ar=3.14*r*r;
   return ar;
}

double area(double a,double b)
{
   double ar=3.14*a*b;
   return ar;
}

double area(double a,double b,double h)
{
   double ar=0.5*h*(a+b);
   return ar;
}

int main()
{
    int choose;
    cout<<"               Program to print the area of different shapes "<<endl;
    cout<<"             ------------------------------------------------"<<endl;
    while(choose!=7)
    {
        cout<<" "<<endl;
        cout<<"Choose the appropriate number to calculate the area of the shapes"<<endl;
        cout<<" "<<endl;
        cout<<"   1 to calculate the area of square      "<<endl;
```

```
cout<<"   2 to calculate the area of rectangle   "<<endl;
cout<<"   3 to calculate the area of triangle    "<<endl;
cout<<"   4 to calculate the area of circle      "<<endl;
cout<<"   5 to calculate the area of ellipse     "<<endl;
cout<<"   6 to calculate the area of a trapezium "<<endl;
cout<<"   7 to exit the program                  "<<endl;
cout<<" :-";cin>>choose;

if(choose==1)
{
    int l;
    cout<<"---------------------- SQUARE ---------------------------"<<endl;
    cout<<"Enter the length of the square (only integer value) : ";
    cin>>l;
    cout<<"            Area of the square = "<<area(l)<<endl;
    cout<<"---------------------------------------------------------"<<endl;
    if(permission()=="no")
    {break;}
}

else if(choose==2)
{
    int l,b;
    cout<<"------------------------- RECTANGLE -------------------------"<<endl;
    cout<<"Enter the length of the rectangle (only integer value)  : ";
    cin>>l;
    cout<<"Enter the breadth of the rectangle (only integer value) : ";
    cin>>b;
    cout<<"              Area of rectangle = "<<area(l,b)<<endl;
    cout<<"-------------------------------------------------------------"<<endl;
    if(permission()=="no")
    {break;}
}

else if(choose==3)
{
    int a,b,c;
    cout<<"------------------------ TRIANGLE ------------------------"<<endl;
    cout<<"Enter the side 1 of the triangle (only integer value) : ";
    cin>>a;
    cout<<"Enter the side 2 of the triangle (only integer value) : ";
```

```
    cin>>b;
    cout<<"Enter the side 3 of the triangle (only integer value) : ";
    cin>>c;
    cout<<"               Area of triangle = "<<area(a,b,c)<<endl;
    cout<<"------------------------------------------------------------"<<endl;
    if(permission()=="no")
    {break;}
}

else if(choose==4)
{
    double r;
    cout<<"---------------------- CIRCLE ------------------------"<<endl;
    cout<<"Enter the radius of the circle : ";
    cin>>r;
    cout<<"    Area of the circle = "<<area(r)<<endl;
    cout<<"------------------------------------------------------------"<<endl;
    if(permission()=="no")
    {break;}
}

else if(choose==5)
{
    double a,b;
    cout<<"-------------------------- ELLIPSE -------------------------"<<endl;
    cout<<"Enter the major axis of the ellipse : ";
    cin>>a;
    cout<<"Enter the minor axis of the ellipse : ";
    cin>>b;
    cout<<"          Area of ellipse = "<<area(a,b)<<endl;
    cout<<"------------------------------------------------------------"<<endl;
    if(permission()=="no")
    {break;}
}

else if (choose==6)
{
    double a,b,h;
    cout<<"-------------------------------- TRAPEZIUM --------------
    -----------------"<<endl;
    cout<<"Enter the smallest parallel side of the trapezium : ";
```

```
            cin>>a;
            cout<<"Enter the largest parallel side of the trapezium  : ";
            cin>>b;
            cout<<"Enter the height of the trapezium                 : ";
            cin>>h;
            cout<<"            Area of trapezium = "<<area(a,b,h)<<endl;
            cout<<"-------------------------------------------------------------
            ---------------"<<endl;
            if(permission()=="no")
            {break;}
        }

        else if (choose==7)
        {break;}

        else
        {
            cout<<" "<<endl;
            cout<<"---------------- Invalid Entry -----------------"<<endl;
            cout<<" "<<endl;
        }
    }
cout<<"       ----------------- Thank You -----------------"<<endl;
return 0;
}
```

SAMPLE INPUT-OUTPUT

```
              Program to print the area of different shapes
             ----------------------------------------------

Choose the appropriate number to calculate the area of the shapes

   1 to calculate the area of square
   2 to calculate the area of rectangle
   3 to calculate the area of triangle
   4 to calculate the area of circle
   5 to calculate the area of ellipse
   6 to calculate the area of a trapezium
   7 to exit the program
 :-1
---------------------- SQUARE --------------------------
Enter the length of the square (only integer value) : 4
           Area of the square = 16
-------------------------------------------------------
         Do you want to continue ?
                yes or no?
 :-yes

Choose the appropriate number to calculate the area of the shapes

   1 to calculate the area of square
   2 to calculate the area of rectangle
   3 to calculate the area of triangle
   4 to calculate the area of circle
   5 to calculate the area of ellipse
   6 to calculate the area of a trapezium
   7 to exit the program
 :-2
------------------------ RECTANGLE ------------------------
Enter the length of the rectangle (only integer value)  : 7
Enter the breadth of the rectangle (only integer value) : 8
             Area of rectangle = 56
-------------------------------------------------------------
         Do you want to continue ?
                yes or no?
 :-yes

Choose the appropriate number to calculate the area of the shapes

   1 to calculate the area of square
   2 to calculate the area of rectangle
   3 to calculate the area of triangle
   4 to calculate the area of circle
   5 to calculate the area of ellipse
   6 to calculate the area of a trapezium
   7 to exit the program
 :-3
------------------------ TRIANGLE -----------------------
Enter the side 1 of the triangle (only integer value) : 3
Enter the side 2 of the triangle (only integer value) : 4
Enter the side 3 of the triangle (only integer value) : 5
             Area of triangle = 6
-------------------------------------------------------------
         Do you want to continue ?
                yes or no?
 :-yes
```

```
Choose the appropriate number to calculate the area of the shapes

   1 to calculate the area of square
   2 to calculate the area of rectangle
   3 to calculate the area of triangle
   4 to calculate the area of circle
   5 to calculate the area of ellipse
   6 to calculate the area of a trapezium
   7 to exit the program
 :-4
----------------------- CIRCLE -------------------------
Enter the radius of the circle : 6
    Area of the circle = 113.04
------------------------------------------------------------
          Do you want to continue ?
                  yes or no?
 :-yes

Choose the appropriate number to calculate the area of the shapes

   1 to calculate the area of square
   2 to calculate the area of rectangle
   3 to calculate the area of triangle
   4 to calculate the area of circle
   5 to calculate the area of ellipse
   6 to calculate the area of a trapezium
   7 to exit the program
 :-5
------------------------- ELLIPSE -------------------------
Enter the major axis of the ellipse : 3
Enter the minor axis of the ellipse : 6
         Area of ellipse = 56.52
------------------------------------------------------------
         Do you want to continue ?
                yes or no?
 :-yes

Choose the appropriate number to calculate the area of the shapes

   1 to calculate the area of square
   2 to calculate the area of rectangle
   3 to calculate the area of triangle
   4 to calculate the area of circle
   5 to calculate the area of ellipse
   6 to calculate the area of a trapezium
   7 to exit the program
 :-6
------------------------------- TRAPEZIUM ------------------------------
Enter the smallest parallel side of the trapezium : 4
Enter the largest parallel side of the trapezium  : 6
Enter the height of the trapezium                 : 7
           Area of trapezium = 35
------------------------------------------------------------------------
         Do you want to continue ?
                yes or no?
 :-yes

Choose the appropriate number to calculate the area of the shapes

   1 to calculate the area of square
   2 to calculate the area of rectangle
   3 to calculate the area of triangle
   4 to calculate the area of circle
   5 to calculate the area of ellipse
   6 to calculate the area of a trapezium
   7 to exit the program
 :-7
       ----------------- Thank You -----------------
```

BANK TRANSACTIONS

AIM

Program using classes to perform bank transaction for n customers (cust_name, acc_no, acc_type, balance). The program should be menu driven and it should have the following menus like adding new account, withdraw (keep a min balance of 500), deposit, balance enquiry and account statement (cust_name, acc_no, acc_type, balance)

PROGRAM

```
#include <iostream>
#include <string>

using namespace std;

int cnt=0;

class ACCOUNT
{
    string cust_name,acc_type;
    int acc_no;
    float balance;

public:
    string check_type();
    void account();
    void withdraw();
    void deposit();
    void bal_enquiry();
    void acc_state();
};

string ACCOUNT:: check_type()
{return acc_type;}

void ACCOUNT::account()
{
    string n1,n2;
    cout<<"-------------------- New Account --------------------"<<endl;
    cout<<"   Enter your first name  : ";
    cin>>n1;
```

```
    cout<<"   Enter your second name : ";
    cin>>n2;
    cust_name=n1+" "+n2;
    cout<<" "<<endl;

    cout<<"              Types of accounts"<<endl;
    cout<<"   FD  : no withdraw or deposit for 5 years"<<endl;
    cout<<"   uFD : withdraw or deposit at any your will"<<endl;
    cout<<" "<<endl;
    cout<<"   Enter your account type : ";
    cin>>acc_type;
    acc_no=cnt;
    while(acc_type!="FD"&&acc_type!="uFD")
    {
      cout<<" "<<endl;
      cout<<"   ---------- Invalid Account Type ----------"<<endl;
      cout<<" "<<endl;
      cout<<"   Enter your account type : ";
      cin>>acc_type;
    }
    cout<<" "<<endl;

    cout<<"   Enter an initial deposit(deposit>=500) : ";
    cin>>balance;
    while(balance<500)
    {
        cout<<" "<<endl;
        cout<<"   ------------- Invalid Amount ------------"<<endl;
        cout<<" "<<endl;
        cout<<"   Enter an initial deposit(deposit>=500) : ";
        cin>>balance;
    }
    cout<<"-------------------------------------------------------"<<endl;
}

void ACCOUNT::deposit()
{
  float dep;
  cout<<"----------------- Deposit -----------------"<<endl;
  cout<<"   Enter the amount to be deposited : ";
  cin>>dep;
```

```
  balance=balance+dep;
  cout<<" "<<endl;
  cout<<"   Your current balance = "<<balance<<endl;
  cout<<" "<<endl;
  cout<<"-----------------------------------------"<<endl;
}

void ACCOUNT::withdraw()
{
  float draw;
  cout<<"--------------- Withdrawal ---------------"<<endl;
  cout<<"   Enter the amount to be withdrawn : ";
  cin>>draw;
  if(balance-draw>=500)
  {balance=balance-draw;}
  else
  {
      cout<<" "<<endl;
      cout<<"   ----- Insufficient Balance -----"<<endl;
      cout<<" "<<endl;
  }
  cout<<" "<<endl;
  cout<<"   Your current balance = "<<balance<<endl;
  cout<<" "<<endl;
  cout<<"-----------------------------------------"<<endl;
}

void ACCOUNT:: bal_enquiry()
{
     cout<<"-------- Balance Enquiry --------"<<endl;
     cout<<"   Your current balance = "<<balance<<endl;
     cout<<"---------------------------------"<<endl;
 }

void ACCOUNT::acc_state()
{
     cout<<"----------- Account Statement -----------"<<endl;
     cout<<"   Name         : "<<cust_name<<endl;
     cout<<"   Account no   : "<<acc_no+666<<endl;
     cout<<"   Account type : "<<acc_type<<endl;
     cout<<"   Balance      : "<<balance<<endl;
```

```
     cout<<"----------------------------------------"<<endl;
}

string continue_not()
{
    string option;
    cout<<" "<<endl;
    cout<<"   Would you like to continue banking ?"<<endl;
    cout<<"              yes or no?               "<<endl;
    cout<<":--";
    cin>>option;
    while(option!="yes" && option!="no")
    {
        cout<<" "<<endl;
        cout<<"   ---------- Invalid Entry -----------"<<endl;
        cout<<" "<<endl;
        cout<<"   Would you like to continue banking ?"<<endl;
        cout<<"               yes or no?              "<<endl;
        cout<<":--";
        cin>>option;
    }
    return option;
}

int get_num()
{
    int x;
    cout<<"------------------ Account Number ------------------"<<endl;
    cout<<"   Enter your account number : ";
    cin>>x;
    while(x<666)
    {
        cout<<" "<<endl;
        cout<<"   ---------- Invalid Account Number -----------"<<endl;
        cout<<" "<<endl;
        cout<<"   Enter your account number :";
        cin>>x;
    }
    while(x-666>cnt)
    {
    cout<<" "<<endl;
```

```
    cout<<"   ---------- Invalid Account Number -----------"<<endl;
    cout<<" "<<endl;
    cout<<"   Enter your account number :";
    cin>>x;
    }
    cout<<"-------------------------------------------------"<<endl;
    cout<<" "<<endl;

    return x-666;
}

int main()
{
    int choose;
    ACCOUNT account_list[100];

    cout<<"------------- Welcome to XYZ bank online portal -------------"<<endl;

    while(choose!=6)
    {
        cout<<" "<<endl;
        cout<<"   Enter the following option to continue"<<endl;
        cout<<"----------------------------------------"<<endl;
        cout<<"   1 to create a new account              "<<endl;
        cout<<"   2 to deposit money to your account     "<<endl;
        cout<<"   3 to withdraw money from your account  "<<endl;
        cout<<"   4 to check your account balance        "<<endl;
        cout<<"   5 to get your account statement        "<<endl;
        cout<<"   6 to end banking                       "<<endl;
        cout<<"----------------------------------------"<<endl;
        cout<<":--";
        cin>>choose;
        cout<<" "<<endl;

        if(choose==1)
        {
            account_list[cnt].account();
            cout<<" "<<endl;
            cout<<"   +================================================+"<<endl;
            cout<<"   |          Your account number is "<<cnt+666<<"
            |"<<endl;
```

```
        cout<<"   |   Save it for future access into your account   |"<<endl;
        cout<<"   +=================================================+"<<endl;
        cnt=cnt+1;
        if(continue_not()=="no")
        {break;}
    }

    else if(choose==2)
    {
        int temp1=get_num();
        string temp2=account_list[temp1].check_type();
        if(temp2=="uFD")
        {
            account_list[temp1].deposit();
            if(continue_not()=="no")
            {break;}
        }
        else
        {
            cout<<" "<<endl;
            cout<<"   +=================================================+"<<endl;
            cout<<"   |                Sorry FD account type             |"<<endl;
            cout<<"   |           Depositing is not permitted            |"<<endl;
            cout<<"   +=================================================+"<<endl;
           if(continue_not()=="no")
            {break;}
        }
    }

    else if(choose==3)
    {
        int temp1=get_num();
        string temp2=account_list[temp1].check_type();
        if(temp2=="uFD")
        {
            account_list[temp1].withdraw();
            if(continue_not()=="no")
            {break;}
        }
        else
        {
```

```
                cout<<" "<<endl;
                cout<<"   +================================================+"<<endl;
                cout<<"   |               Sorry FD account type            |"<<endl;
                cout<<"   |            Withdrawal is not permitted         |"<<endl;
                cout<<"   +================================================+"<<endl;
                if(continue_not()=="no")
                {break;}
            }
        }

        else if(choose==4)
        {
            account_list[get_num()].bal_enquiry();
            if(continue_not()=="no")
            {break;}
        }

        else if (choose==5)
        {
            int temp=get_num();
            account_list[temp].acc_state();
            if(continue_not()=="no")
            {break;}
        }

        else if(choose==6)
        {break;}

        else
        {
         cout<<"   ----------- Invalid Entry ------------"<<endl;
        }
    }
cout<<"         ------------- Thank You --------------"<<endl;
return 0;}
```

SAMPLE INPUT-OUTPUT

```
------------- Welcome to XYZ bank online portal -------------

   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--1

-------------------- New Account --------------------
   Enter your first name  : Noble
   Enter your second name : Austine

              Types of accounts
   FD  : no withdraw or deposit for 5 years
   uFD : withdraw or deposit at any your will

   Enter your account type : FD

   Enter an initial deposit(deposit>=500) : 300

   ------------- Invalid Amount ------------

   Enter an initial deposit(deposit>=500) : 3000
-----------------------------------------------------

   +================================================+
   |          Your account number is 666            |
   |   Save it for future access into your account  |
   +================================================+

   Would you like to continue banking ?
              yes or no?
:-yes
```

```
   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--2

----------------- Account Number -----------------
   Enter your account number : 333

   ---------- Invalid Account Number -----------

   Enter your account number :666
-------------------------------------------------



   +================================================+
   |              Sorry FD account type             |
   |           Depositing is not permitted          |
   +================================================+

   Would you like to continue banking ?
              yes or no?
:-yes

   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--3

----------------- Account Number -----------------
   Enter your account number : 999

   ---------- Invalid Account Number -----------

   Enter your account number :666
-------------------------------------------------



   +================================================+
   |              Sorry FD account type             |
   |            Withdrawal is not permitted         |
   +================================================+

   Would you like to continue banking ?
              yes or no?
:-yes
```

```
   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--4

------------------ Account Number ------------------
   Enter your account number : 666
-----------------------------------------------------

-------- Balance Enquiry --------
   Your current balance = 3000
---------------------------------

   Would you like to continue banking ?
              yes or no?
:-yes

   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--5

------------------ Account Number ------------------
   Enter your account number : 666
-----------------------------------------------------

----------- Account Statement -----------
   Name         : Noble Austine
   Account no   : 666
   Account type : FD
   Balance      : 3000
---------------------------------------

   Would you like to continue banking ?
              yes or no?
:-no
         ------------- Thank You --------------
```

```
   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--1

-------------------- New Account --------------------
   Enter your first name  : Abhin
   Enter your second name : P

              Types of accounts
   FD  : no withdraw or deposit for 5 years
   uFD : withdraw or deposit at any your will

   Enter your account type : uFD

   Enter an initial deposit(deposit>=500) : 500
-----------------------------------------------------

   +================================================+
   |          Your account number is 667            |
   |   Save it for future access into your account  |
   +================================================+

   Would you like to continue banking ?
              yes or no?
:-yes

   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--2

------------------ Account Number ------------------
   Enter your account number : 667
-----------------------------------------------------

---------------- Deposit ----------------
   Enter the amount to be deposited : 500

   Your current balance = 1000

-----------------------------------------

   Would you like to continue banking ?
              yes or no?
:-yes
```

```
   Enter the following option to continue
----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
----------------------------------------
:--3

----------------- Account Number -----------------
   Enter your account number : 667
--------------------------------------------------

-------------- Withdrawal ---------------
   Enter the amount to be withdrawn : 600

   ----- Insufficient Balance -----


   Your current balance = 1000

----------------------------------------

   Would you like to continue banking ?
              yes or no?
:-yes

   Enter the following option to continue
----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
----------------------------------------
:--3

----------------- Account Number -----------------
   Enter your account number : 667
--------------------------------------------------

-------------- Withdrawal ---------------
   Enter the amount to be withdrawn : 300

   Your current balance = 700

----------------------------------------

   Would you like to continue banking ?
              yes or no?
:-yes
```

```
   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--4

----------------- Account Number -----------------
   Enter your account number : 667
--------------------------------------------------

-------- Balance Enquiry --------
   Your current balance = 700
--------------------------------

   Would you like to continue banking ?
              yes or no?
:-yes

   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--5

----------------- Account Number -----------------
   Enter your account number : 667
--------------------------------------------------

----------- Account Statement -----------
   Name         : Abhin P
   Account no   : 667
   Account type : uFD
   Balance      : 700
---------------------------------------

   Would you like to continue banking ?
              yes or no?
:-yes

   Enter the following option to continue
-----------------------------------------
   1 to create a new account
   2 to deposit money to your account
   3 to withdraw money from your account
   4 to check your account balance
   5 to get your account statement
   6 to end banking
-----------------------------------------
:--6

-------------- Thank You --------------
```

STRING OPERATIONS

AIM

Program to perform operations such as compare, concatenate and length on String objects

PROGRAM

```
#include <iostream>
#include <cstring>

using namespace std ;

class STRING
{
    char* str;
    int length;

public:
    STRING()
    {
        length=0;
        str=new char[length+1];
    }
    STRING(const char*s);

    void display()
    {cout<<str;}

friend STRING concatenate(STRING s1,STRING s2);
friend void compare(STRING s1,STRING s2);
};

STRING :: STRING(const char*s)
{
    length=strlen(s);
    str=new char[length+1];
    strcpy(str,s);
}

STRING concatenate(STRING s1,STRING s2)
{
```

```
    STRING s;
    s.length=s1.length + s2.length;
    s.str= new char[s.length +1];
    strcpy(s.str,s1.str);
    strcat(s.str,s2.str);
    return s;
}

void compare(STRING s1,STRING s2)
{
    if(s1.length>s2.length)
    {
        cout<<"   '"<<s1.str<<"' has more number of characters "<<endl;
    }

    else if (s1.length<s2.length)
    {
        cout<<"   '"<<s2.str<<"' has more number of characters "<<endl;
    }

    else
    {
        cout<<"   '"<<s1.str<<"' and '"<<s2.str<<"' both have same number
        of characters "<<endl;
    }
}

int main()
{
    int option =6;
    char* temp1 = new char[50];
    char* temp2 = new char [50];

    cout<<"    Program to compare and concatenate strings "<<endl;
    cout<<"   ------------------------------------------"<<endl;

    while(option==6)
    {
        cout<<" "<<endl;
        cout<<"   Enter the first string  : ";
        cin>>temp1;
```

```
        STRING s1(temp1);
        cout<<" "<<endl;

        cout<<"   Enter the second string : ";
        cin>>temp2;
        STRING s2(temp2);

        STRING s3=concatenate(s1,s2);
        cout<<"  "<<endl;
        cout<<"   ";s1.display();cout<<" + ";s2.display();cout<<" = ";
        s3.display();cout<<" "<<endl;
        cout<<"  "<<endl;
        compare(s1,s2);
        cout<<" "<<endl;

        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other digit to exit the program"<<endl;
        cout<<":--";
        cin>>option;
    }
    cout<<"               ------------- Thank You -------------"<<endl;
    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
    Program to compare and concatenate strings
   ------------------------------------------

   Enter the first string  : Take

   Enter the second string : out

   Take + out = Takeout

   'Take' has more number of characters

                Would you like to continue ?
   Enter 6 to continue or any other digit to exit the program
:--6

   Enter the first string  : Power

   Enter the second string : station

   Power + station = Powerstation

   'station' has more number of characters

                Would you like to continue ?
   Enter 6 to continue or any other digit to exit the program
:--6

   Enter the first string  : Hard

   Enter the second string : work

   Hard + work = Hardwork

   'Hard' and 'work' both have same number of characters

                Would you like to continue ?
   Enter 6 to continue or any other digit to exit the program
:--3
                ------------ Thank You ------------
```

CONSTRUCTORS AND DESTRUCTORS

AIM

Program to demonstrate the order of execution of constructors & destructors for a matrix class

PROGRAM

```
#include<iostream>
using namespace std;

class matrix
{
    int row,col;
    int**m;
public:
    matrix(int,int);
    ~matrix();
    void input(void);
    void display(void);
    void add(matrix &,matrix &);
};

matrix::matrix(int x,int y)
{
    row=x;
    col=y;
    m=new int*[row];
    for(int i=0;i<row;i++)
    {
        m[i]=new int[col];
    }
    cout<<" "<<endl;
    cout<<"   ----------- Constructor called -----------"<<endl;
    cout<<" "<<endl;
}

matrix::~matrix()
{
    for(int i=0;i<row;i++)
    {
```

```
        delete m[i];
    }
    delete m;
    cout<<" "<<endl;
    cout<<"   ----------- Destructor called ------------"<<endl;
    cout<<" "<<endl;
}

void matrix::input()
{
    for(int i=0;i<row;i++)
    {
        for(int j=0;j<col;j++)
        {
            cout<<"   m"<<i+1<<j+1<<"= ";
            cin>>m[i][j];
        }
        cout<<" "<<endl;
    }
}

void matrix::display()
{
    for(int i=0;i<row;i++)
    {
        cout<<"   ";
        for(int j=0;j<col;j++)
        {
            cout<<m[i][j]<<" ";
        }
        cout<<" "<<endl;
    }
}

void matrix::add(matrix &M1,matrix &M2)
{

        for(int i=0;i<row;i++)
        {
            for(int j=0;j<col;j++)
            {
```

```
                m[i][j]=M1.m[i][j] + M2.m[i][j];
            }
        }

}

int main()
{
    int x,y,w,z;
    cout<<"              Program to add two matrices"<<endl;
    cout<<"             ----------------------------"<<endl;
    cout<<" "<<endl;
    cout<<"   Enter the number of rows of the Matrix-1    : ";
    cin>>x;
    cout<<"   Enter the number of columns of the Matrix-1 : ";
    cin>>y;
    cout<<" "<<endl;

    matrix m1(x,y);
    cout<<"   Enter the elements of matrix-1 : "<<endl;
    cout<<" "<<endl;
    m1.input();
    cout<<"   Matrix-1 :"<<endl;
    cout<<" "<<endl;
    m1.display();
    cout<<" "<<endl;

    cout<<"   Enter the number of rows of the Matrix-2    : ";
    cin>>w;
    cout<<"   Enter the number of columns of the Matrix-2 : ";
    cin>>z;
    cout<<" "<<endl;

    matrix m2(w,z);
    cout<<"   Enter the elements of matrix-2 : "<<endl;
    cout<<" "<<endl;
    m2.input();
    cout<<"   Matrix-2 : "<<endl;
    m2.display();
    cout<<" "<<endl;
```

```
    if(x==w&&y==z)
    {
        matrix m3(x,y);
        cout<<"   Matrix-1 + Matrix-2 = Matrix-3 "<<endl;
        cout<<" "<<endl;
        m3.add(m1,m2);
        cout<<"   Matrix-3 : "<<endl;
        cout<<" "<<endl;
        m3.display();
    }

    else
    {
            cout<<" "<<endl;
            cout<<"            Addition cannot be performed"<<endl;
            cout<<"   Number of rows and columns are not matching"<<endl;
            cout<<" "<<endl;
    }

    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
            Program to add two matrices
           ----------------------------

Enter the number of rows of the Matrix-1    : 2
Enter the number of columns of the Matrix-1 : 2


---------- Constructor called ----------

Enter the elements of matrix-1 :

m11= 1
m12= 2

m21= 3
m22= 4

Matrix-1 :

1 2
3 4

Enter the number of rows of the Matrix-2    : 2
Enter the number of columns of the Matrix-2 : 1


---------- Constructor called ----------

Enter the elements of matrix-2 :

m11= 1

m21= 2

Matrix-2 :
1
2


         Addition cannot be performed
Number of rows and columns are not matching


---------- Destructor called ------------


---------- Destructor called ------------
```

```
            Program to add two matrices
           ----------------------------

  Enter the number of rows of the Matrix-1    : 2
  Enter the number of columns of the Matrix-1 : 3


  ----------- Constructor called -----------

  Enter the elements of matrix-1 :

  m11= 1
  m12= 2
  m13= 1

  m21= 2
  m22= 0
  m23= 3

  Matrix-1 :

  1 2 1
  2 0 3

  Enter the number of rows of the Matrix-2    : 2
  Enter the number of columns of the Matrix-2 : 3


  ----------- Constructor called -----------

  Enter the elements of matrix-2 :

  m11= 2
  m12= 3
  m13= 1

  m21= 1
  m22= 0
  m23= 2

  Matrix-2 :
  2 3 1
  1 0 2


  ----------- Constructor called -----------

  Matrix-1 + Matrix-2 = Matrix-3

  Matrix-3 :

  3 5 2
  3 0 5

  ----------- Destructor called ------------


  ----------- Destructor called ------------

  ----------- Destructor called ------------
```

TIME CLASS

AIM

Create a class TIME with members hours, minutes, seconds. Take input, add two time objects by passing objects to function and display result

PROGRAM

```
#include <iostream>

using namespace std;

class TIME
{
    int hours,minutes,seconds;

public:
    void input();
    void add(TIME,TIME);
    void display();
};

void TIME::input()
{
    cout<<"   Enter hours = ";
    cin>>hours;
    cout<<"   Enter minutes = ";
    cin>>minutes;
    cout<<"   Enter seconds = ";
    cin>>seconds;
}

void TIME::add(TIME t1,TIME t2)
{
    seconds=t1.seconds+t2.seconds;
    minutes=seconds/60;
    seconds=seconds%60;
    minutes=minutes+t1.minutes+t2.minutes;
    hours=minutes/60;
    minutes=minutes%60;
    hours=hours+t1.hours+t2.hours;
```

```
}

void TIME::display()
{
    cout<<hours<<" hours, "<<minutes<<" minutes and "<<seconds<<" seconds "<<endl;
}

int main()
{
    string choice="yes";
    cout<<"              Program to add two time periods "<<endl;
    cout<<"             ---------------------------------"<<endl;
    TIME time1,time2,time3;

    while(choice=="yes")
    {
        cout<<"   "<<endl;
        cout<<"        Enter 1st time period :"<<endl;;
        cout<<"--------------------------------------"<<endl;
        time1.input();
        cout<<"--------------------------------------"<<endl;

        cout<<"   "<<endl;
        cout<<"        Enter 2nd time period :"<<endl;
         cout<<"--------------------------------------"<<endl;
        time2.input();
        cout<<"--------------------------------------"<<endl;

        time3.add(time1,time2);
        cout<<"   "<<endl;
        cout<<"   Sum of 1st and 2nd time period : ";
        time3.display();

        cout<<"   "<<endl;
        cout<<"   Do you want to continue?"<<endl;
        cout<<"          yes or no        "<<endl;
        cout<<":--";
        cin>>choice;

    }
```

```
    while(choice!="yes"&&choice!="no")
    {
        cout<<"   "<<endl;
        cout<<"------------- Invalid Entry -------------"<<endl;
        cout<<"   "<<endl;
        cout<<"Do you want to continue?"<<endl;
        cout<<"       yes or no        "<<endl;
        cout<<":--";
        cin>>choice;
    }
    cout<<"           ----------- Thank You -----------"<<endl;

    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
             Program to add two time periods
            --------------------------------

       Enter 1st time period :
-------------------------------------
   Enter hours = 2
   Enter minutes = 24
   Enter seconds = 45
-------------------------------------

       Enter 2nd time period :
-------------------------------------
   Enter hours = 3
   Enter minutes = 56
   Enter seconds = 102
-------------------------------------

   Sum of 1st and 2nd time period : 6 hours, 22 minutes and 27 seconds

   Do you want to continue?
         yes or no
:--no
          ----------- Thank You -----------
```

MATRIX CLASS AND OPERATIONS

AIM

Write a C++ program to implement a class MATRIX with member functions such as matrix_add, matrix_mult, matrix_transpose, matrix_trace etc

PROGRAM

```
#include <iostream>

using namespace std;

class MATRIX
{
    int row,col;
    int**m;

public:

    MATRIX(int,int);
    ~MATRIX();
    void input(void);
    void display(void);
    void matrix_add(MATRIX &,MATRIX &);
    void matrix_mul(MATRIX &,MATRIX &);
    void matrix_transpose(MATRIX &);
    int matrix_trace(void);

};

MATRIX::MATRIX(int x,int y)
{
    row=x;
    col=y;
    m=new int*[row];
    for(int i=0;i<row;i++)
    {m[i]=new int[col];}
}

MATRIX::~MATRIX()
{
    for(int i=0;i<row;i++)
```

```
    {delete m[i];}
    delete m;
}

void MATRIX::input()
{
    cout<<" "<<endl;
    for(int i=0;i<row;i++)
    {
        for(int j=0;j<col;j++)
        {
            cout<<"   m("<<i+1<<j+1<<")"<<"=";
            cin>>m[i][j];
        }
        cout<<" "<<endl;
    }

}

void MATRIX::display()
{
    cout<<" "<<endl;
    for(int i=0;i<row;i++)
    {
        cout<<"   ";
        for(int j=0;j<col;j++)
        {
            cout<<m[i][j]<<" ";
        }
        cout<<" "<<endl;
    }
    cout<<" "<<endl;
}

void MATRIX::matrix_add(MATRIX &M1,MATRIX &M2)
{
     for(int i=0;i<row;i++)
     {
         for(int j=0;j<col;j++)
         {
             m[i][j]=M1.m[i][j] + M2.m[i][j];
```

```
         }
     }

}

void MATRIX::matrix_mul(MATRIX &M1,MATRIX &M2)
{
    for(int i=0;i<row;i++)
    {
        for(int j=0;j<col;j++)
        {
            m[i][j]=0;
            for(int k=0;k<M1.col;k++)
            {
                m[i][j]= m[i][j]+ M1.m[i][k]*M2.m[k][j];
            }
        }
    }

}

void MATRIX::matrix_transpose(MATRIX &M)
{
   for(int i=0;i<row;i++)
   {
       for(int j=0;j<col;j++)
       {
           m[i][j]=M.m[j][i];
       }
   }
}

int MATRIX::matrix_trace(void)
{
   int sum=0;
   for(int i=0;i<row;i++)
   {
       for(int j=0;j<col;j++)
       {
           if(i==j)
           {
```

```
            sum=sum+m[i][j];
          }

      }
   }
   return sum;
}

int main()
{
    int x,y,w,z;
    int check =6;
    cout<<"          Matrix calculation program "<<endl;
    cout<<"         ----------------------------"<<endl;

 while(check==6)
 {
     cout<<" "<<endl;
     cout<<"-----------------------------------------------------"<<endl;
     cout<<" "<<endl;
     cout<<"   Enter the number of rows of the Matrix-1    : ";
     cin>>x;
     cout<<"   Enter the number of columns of the Matrix-1 : ";
     cin>>y;
     cout<<" "<<endl;
     MATRIX m1(x,y);

     cout<<"   Enter the elements of Matrix-1 : "<<endl;
     m1.input();
     cout<<"   Matrix-1 :"<<endl;
     m1.display();


     cout<<"   Enter the number of rows of the Matrix-2    : ";
     cin>>w;
     cout<<"   Enter the number of columns of the Matrix-2 : ";
     cin>>z;
     cout<<" "<<endl;
     MATRIX m2(w,z);

     cout<<"   Enter the elements of Matrix-2 : "<<endl;
```

```
m2.input();
cout<<"   Matrix-2 : "<<endl;
m2.display();
cout<<"-------------------------------------------------"<<endl;

if(x==w&&y==z)
{
    MATRIX m3(x,y);
    m3.matrix_add(m1,m2);
    cout<<" "<<endl;
    cout<<"-----------------------------------------"<<endl;
    cout<<" "<<endl;
    cout<<"   Matrix-1 + Matrix-2 = Matrix-3 "<<endl;
    cout<<" "<<endl;
    cout<<"   Matrix-3 : "<<endl;
    m3.display();
    cout<<"-----------------------------------------"<<endl;
}

else
{
    cout<<" "<<endl;
    cout<<"   --- The given two matrices cannot be added ---"<<endl;
    cout<<" "<<endl;
}

if(y==w)
{
    MATRIX m4(x,z);
    m4.matrix_mul(m1,m2);
    cout<<" "<<endl;
    cout<<"-----------------------------------------"<<endl;
    cout<<" "<<endl;
    cout<<"   Matrix-1 x Matrix-2 = Matrix-4 "<<endl;
    cout<<" "<<endl;
    cout<<"   Matrix-4 : "<<endl;
    m4.display();
    cout<<"-----------------------------------------"<<endl;
}

else
```

```
{
    cout<<" "<<endl;
    cout<<"   --- The given two matrices cannot be multiplied ---"<<endl;
    cout<<" "<<endl;
}

MATRIX m5(y,x);
m5.matrix_transpose(m1);
cout<<" "<<endl;
cout<<"-----------------------------------"<<endl;
cout<<" "<<endl;
cout<<"   Transpose of Matrix-1 :"<<endl;
m5.display();
cout<<"-----------------------------------"<<endl;

MATRIX m6(z,w);
m6.matrix_transpose(m2);
cout<<" "<<endl;
cout<<"-----------------------------------"<<endl;
cout<<" "<<endl;
cout<<"   Transpose of Matrix-2 :"<<endl;
m6.display();
cout<<"-----------------------------------"<<endl;

if(x!=y)
{
    cout<<" "<<endl;
    cout<<"   --- Matrix-1 is not a square matrix hence trace
    cannot be determined ---"<<endl;
    cout<<" "<<endl;
}

else
{
    cout<<" "<<endl;
    cout<<"   The trace of the Matrix-1 = "<<m1.matrix_trace()<<endl;
    cout<<" "<<endl;
}

if(w!=z)
{
```

```
        cout<<" "<<endl;
        cout<<"   --- Matrix-2 is not a square matrix hence trace
        cannot be determined ---"<<endl;
        cout<<" "<<endl;
    }
    else
    {
        cout<<" "<<endl;
        cout<<"   The trace of the Matrix-2 = "<<m2.matrix_trace()<<endl;
        cout<<" "<<endl;
    }

    cout<<" "<<endl;
    cout<<"                Would you like to continue ? "<<endl;
    cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
    cout<<":--";
    cin>>check;
    cout<<" "<<endl;

   }

   cout<<"               ------------ Thank You----------------"<<endl;

   return 0;
}
```

SAMPLE INPUT-OUTPUT

```
         Matrix calculation program
        ---------------------------

-----------------------------------------------------

   Enter the number of rows of the Matrix-1    : 2
   Enter the number of columns of the Matrix-1 : 3

   Enter the elements of Matrix-1 :

   m(11)=1
   m(12)=2
   m(13)=1

   m(21)=2
   m(22)=0
   m(23)=3

   Matrix-1 :

   1 2 1
   2 0 3

   Enter the number of rows of the Matrix-2    : 3
   Enter the number of columns of the Matrix-2 : 2

   Enter the elements of Matrix-2 :

   m(11)=1
   m(12)=2

   m(21)=2
   m(22)=3

   m(31)=0
   m(32)=1

   Matrix-2 :

   1 2
   2 3
   0 1

-----------------------------------------------------

   --- The given two matrices cannot be added ---


-------------------------------------------

   Matrix-1 x Matrix-2 = Matrix-4

   Matrix-4 :

   5 9
   2 7

-------------------------------------------

-----------------------------------

   Transpose of Matrix-1 :

   1 2
   2 0
   1 3

-----------------------------------

-----------------------------------

   Transpose of Matrix-2 :

   1 2 0
   2 3 1

-----------------------------------

   --- Matrix-1 is not a square matrix hence trace cannot be determined ---


   --- Matrix-2 is not a square matrix hence trace cannot be determined ---


               Would you like to continue ?
   Enter 6 to continue or any other number to end the program
:--6
```

```
--------------------------------------------------

  Enter the number of rows of the Matrix-1    : 2
  Enter the number of columns of the Matrix-1 : 2

  Enter the elements of Matrix-1 :

  m(11)=1
  m(12)=2

  m(21)=3
  m(22)=4

  Matrix-1 :

  1 2
  3 4

  Enter the number of rows of the Matrix-2    : 2
  Enter the number of columns of the Matrix-2 : 2

  Enter the elements of Matrix-2 :

  m(11)=1
  m(12)=0

  m(21)=0
  m(22)=1

  Matrix-2 :

  1 0
  0 1

--------------------------------------------------


------------------------------------------

   Matrix-1 + Matrix-2 = Matrix-3

   Matrix-3 :

   2 2
   3 5

------------------------------------------

------------------------------------------

   Matrix-1 x Matrix-2 = Matrix-4

   Matrix-4 :

   1 2
   3 4

------------------------------------------

-----------------------------------

   Transpose of Matrix-1 :

   1 3
   2 4

-----------------------------------

-----------------------------------

   Transpose of Matrix-2 :

   1 0
   0 1

-----------------------------------

   The trace of the Matrix-1 = 5


   The trace of the Matrix-2 = 2


              Would you like to continue ?
   Enter 6 to continue or any other number to end the program
:--6
```

```
-----------------------------------------------------

   Enter the number of rows of the Matrix-1    : 1
   Enter the number of columns of the Matrix-1 : 2

   Enter the elements of Matrix-1 :

   m(11)=1
   m(12)=3

   Matrix-1 :

   1 3

   Enter the number of rows of the Matrix-2    : 1
   Enter the number of columns of the Matrix-2 : 2

   Enter the elements of Matrix-2 :

   m(11)=4
   m(12)=5

   Matrix-2 :

   4 5

-----------------------------------------------------

-------------------------------------------

   Matrix-1 + Matrix-2 = Matrix-3

   Matrix-3 :

   5 8

-------------------------------------------

   --- The given two matrices cannot be multiplied ---


---------------------------------

   Transpose of Matrix-1 :

   1
   3

---------------------------------

---------------------------------

   Transpose of Matrix-2 :

   4
   5

---------------------------------

   --- Matrix-1 is not a square matrix hence trace cannot be determined ---


   --- Matrix-2 is not a square matrix hence trace cannot be determined ---


              Would you like to continue ?
   Enter 6 to continue or any other number to end the program
:--3

             ------------ Thank You----------------
```

CONSTRUCTOR OVERLOADING FOR A COMPLEX CLASS

AIM

Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imaginary parts to equal values and third which takes two argument is used to initialized real and imaginary to two different values.

PROGRAM

```
#include<iostream>

using namespace std;

class Complex
{
    float real;
    float imag;

public:

    Complex(void) {};
    Complex(float x)
    {
        real=x;
        imag=x;
    }

    Complex(float x, float y)
    {
        real = x;
        imag = y;
    }

    void display(void)
    {
        if (imag >= 0)
        {
         cout<<"( "<<real<<" + "<<imag<<"i"<<" )";
```

```
        }

        else
        {
         cout<<"( "<<real<<" - "<<(-1)*imag<<"i"<<" )";
        }
     }

    Complex add(Complex);
};

Complex Complex::add(Complex C)
{
    Complex temp;
    temp.real = real+C.real;
    temp.imag = imag+C.imag;
    return temp;
}


int main()
{
    int x,y;
    Complex c3;
    int option=6;
    cout<<"           Program to add two complex numbers "<<endl;
    cout<<"          ------------------------------------"<<endl;

    while(option==6)
    {
        cout<<"   Enter the real part of Complex Number-1          : ";
        cin>>x;
        cout<<"   Enter the imaginary part of Complex Number-1     : ";
        cin>>y;
        Complex c1(x,y);

        cout<<" "<<endl;
        cout<<"   Complex Number-1 : ";
        c1.display();
        cout<<" "<<endl;
        cout<<" "<<endl;
```

```
        cout<<"   Enter the common value for real and imaginary part
        Complex Number-2    : ";
        cin>>x;
        Complex c2(x);

        cout<<" "<<endl;
        cout<<"   Complex Number-2 : ";
        c2.display();
        cout<<" "<<endl;
        cout<<" "<<endl;

        c3=c1.add(c2);
        cout<<"   ";c1.display();cout<<" + ";c2.display();cout<<" = ";c3.display();
        cout<<" "<<endl;
        cout<<" "<<endl;

        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
        cout<<":--";
        cin>>option;
        cout<<" "<<endl;
    }
    cout<<"            ---------- Thank You -----------"<<endl;

    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
          Program to add two complex numbers
         ----------------------------------
  Enter the real part of Complex Number-1          : 3
  Enter the imaginary part of Complex Number-1     : -2

  Complex Number-1 : ( 3 - 2i )

  Enter the common value for real and imaginary part Complex Number-2    : -4

  Complex Number-2 : ( -4 - 4i )

  ( 3 - 2i ) + ( -4 - 4i ) = ( -1 - 6i )

              Would you like to continue ?
  Enter 6 to continue or any other number to end the program
:--3

           ---------- Thank You -----------
```

STATIC MEMBER FUNCTIONS

AIM

Write a C++ program to design a class having static member function named showcount() which has the property of displaying the number of objects created of the class

PROGRAM

```
#include <iostream>

using namespace std;

class gen
{
    int no_members;
    static int cnt;

public:

    gen(int x)
    {
        no_members=x;
        cnt=cnt+1;
    }

    void display(void)
    {
        cout<<"   Number of members : "<<no_members<<endl;
    }

    static void showcount(void)
    {
        cout<<"        Generation :-"<<cnt<<endl;
        cout<<"      ------------------ "<<endl;
    }

};

int gen::cnt;

int main()
```

```
{
    int x;
    int option=6;
    while(option==6)
    {
        cout<<" "<<endl;
        cout<<"        Program to show the members in each generation "<<endl;
        cout<<"       ------------------------------------------------"<<endl;
        cout<<" "<<endl;
        cout<<"   Enter the number of members in your grandmother's generation : ";
        cin>>x;
        gen g1(x);
        cout<<" "<<endl;
        gen::showcount();
        g1.display();
        cout<<" "<<endl;

        cout<<"   Enter the number of members in your mother's generation      : ";
        cin>>x;
        gen g2(x);
        cout<<" "<<endl;
        gen::showcount();
        g2.display();
        cout<<" "<<endl;

        cout<<"   Enter the number of members in your generation               : ";
        cin>>x;
        gen g3(x);
        cout<<" "<<endl;
        gen::showcount();
        g3.display();
        cout<<" "<<endl;

        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
        cout<<":--";
        cin>>option;
        cout<<" "<<endl;
    }

    cout<<"                ---------- Thank You -----------"<<endl;
```

```
    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
        Program to show the members in each generation
       ------------------------------------------------

   Enter the number of members in your grandmother's generation : 3

        Generation :-1
      ------------------
   Number of members : 3

   Enter the number of members in your mother's generation      : 6

        Generation :-2
      ------------------
   Number of members : 6

   Enter the number of members in your generation               : 9

        Generation :-3
      ------------------
   Number of members : 9

               Would you like to continue ?
   Enter 6 to continue or any other number to end the program
:--3

               ---------- Thank You -----------
```

DEPARTMENT STORE

AIM

Write a C++ program using class to process shopping list for a DepartmentalStore. The list include details such as the Code-no and price of each item and perform the operations like adding & deleting items to the list and printing the total value of an order.

PROGRAM

```
#include <iostream>
#include <cstring>

using namespace std;

int count1=0;
int count2=0;

class item
{
    string name;
    int code;
    int quantity;
    float price;

public:

    item()
     {
        quantity=0;
        price=0;
     }

    void input(string w,int x,float y,int z)
    {
        name=w;
        code=x;
        price=y;
        quantity=z;
    }

    int get_code(void)
```

```
    {
        return code;
    }

    void add_item(int);
    void delete_item(int);

    int get_quantity(void)
    {
        return quantity;
    }

    void alter_quantity(int x)
    {
        quantity=x;
    }

    int get_cost(void)
    {
        return price*quantity;
    }

    void display(void)
    {
        cout<<"   "<<name<<"\t\t"<<code<<"\t"<<quantity<<"\t"<<price<<endl;
    }
};

void item:: add_item(int x)
{
  quantity=quantity+x;
}

void item:: delete_item(int x)
{
   quantity=quantity-x;
}

string permission()
{
    string check;
```

```
    cout<<" "<<endl;
    cout<<"   Do you want to continue ?"<<endl;
    cout<<"           yes or no?       "<<endl;
    cout<<":--";
    cin>>check;
    if(check!="yes"&&check!="no")
    {
        cout<<" "<<endl;
        cout<<"   ------------ Invalid Entry -------------"<<endl;
        cout<<" "<<endl;
        cout<<"   Do you want to continue ?"<<endl;
        cout<<"           yes or no?       "<<endl;
        cout<<":--";
        cin>>check;
    }
    return check;
}

int main()
{
    item inventory[50];
    item shopping_list[50];

    int option;
    bool verify=false;

    while(option!=11)
    {
        cout<<"   ============ INVENTORY =============="<<endl;
        cout<<" "<<endl;
        cout<<"   Choose any of the following option to continue "<<endl;
        cout<<"------------------------------------------------"<<endl;
        cout<<"    1  to enter a new product to the inventory    "<<endl;
        cout<<"    2  to add an item to the stock                "<<endl;
        cout<<"    3  to purchase a product                      "<<endl;
        cout<<"    4  to increase the number of items purchased  "<<endl;
        cout<<"    5  to decrease the number of items purchased  "<<endl;
        cout<<"    6  to remove an item from the stock           "<<endl;
        cout<<"    7  to remove a product from the inventory     "<<endl;
        cout<<"    8  to return a product                        "<<endl;
        cout<<"    9  to get the bill of items                   "<<endl;
```

```
cout<<"    10 to get the list of items                    "<<endl;
cout<<"    11 to exit from the program                    "<<endl;
cout<<" :--";
cin>>option;

if(option==1)
{
    int y=1;
    while(y==1)
    {
        string name;
        float price;
        int code,quantity;
        cout<<"------------------New Product---------------"<<endl;
        cout<<"   Enter the name of the item  : ";
        cin>>name;
        cout<<"   Enter the item code         : ";
        cin>>code;
        cout<<"   Enter the item price        : ";
        cin>>price;
        cout<<"   Enter the number of items   : ";
        cin>>quantity;

        inventory[count1].input(name,code,price,quantity);
        count1=count1+1;
        cout<<" "<<endl;
        cout<<"   ------ New product added ------"<<endl;
        cout<<" "<<endl;
        cout<<"   Enter 1 to continue adding new products or 0 to
        print the list"<<endl;
        cout<<":--";
        cin>>y;

    }

    float sum=0;
    cout<<"----------------- List of Products ----------------"<<endl;
    for(int i=0;i<count1;i++)
    {
        sum=sum+inventory[i].get_cost();
    }
```

```
    cout<<"   NAME"<<"\t\tCODE"<<"\tNUMBER"<<"\tPRICE"<<endl;
    cout<<"   ------------------------------------------------"<<endl;
    for(int i=0;i<count1;i++)
    {
        inventory[i].display();
    }
    cout<<"  "<<endl;

    if(permission()=="no")
       {break;}
}

else if(option==2)
{
     int temp1,temp2;
     cout<<"----------------- Adding to stock----------------"<<endl;
     cout<<"   Enter the item code       : ";
     cin>>temp1;
     cout<<"   Enter the number of items : ";
     cin>>temp2;
     for(int i=0;i<count1;i++)
     {
         if(temp1==inventory[i].get_code())
         {
             inventory[i].add_item(temp2);
             cout<<" "<<endl;
             cout<<"   ------ Number of items increased ------"<<endl;
             cout<<" "<<endl;
             verify=true;
         }
     }
     if(verify==false)
     {
         cout<<" "<<endl;
         cout<<"   ------- Invalid Item Code ---------"<<endl;
         cout<<" "<<endl;

     }
     verify=false;
```

```
     if(permission()=="no")
        {break;}

}

else if(option==3)
{
    int y=1;
    while(y==1)
    {
        int temp1,temp2;
        cout<<"----------------- Purchase ----------------"<<endl;
        cout<<"   Enter the item code       : ";
        cin>>temp1;
        cout<<"   Enter the number of items : ";
        cin>>temp2;
        for(int i=0;i<count1;i++)
        {
            if(temp1==inventory[i].get_code())
            {

                if(inventory[i].get_quantity()>=temp2)
                {
                    shopping_list[count2]=inventory[i];
                    shopping_list[count2].alter_quantity(temp2);
                    inventory[i].delete_item(temp2);
                    count2=count2+1;
                    cout<<" "<<endl;
                    cout<<"   ------ Purchased product added
                    to the bill ------"<<endl;
                    cout<<" "<<endl;

                 }
                 else
                 {
                     cout<<" "<<endl;
                     cout<<"   ------ The item is out of stock ------"<<endl;
                     cout<<" "<<endl;
                 }
                  verify=true;
              }
```

```
            }
            if(verify==false)
            {
                cout<<" "<<endl;
                cout<<"   ------- Invalid Item Code ---------"<<endl;
                cout<<" "<<endl;
            }
            verify=false;
            cout<<"   Enter 1 to continue purchasing new products or 0
            to print the bill"<<endl;
            cout<<":--";
            cin>>y;

        }

       cout<<"   ---------------------- BILL ----------------------"<<endl;
                 cout<<"   NAME"<<"\t\tCODE"<<"\tNUMBER"<<"\tPRICE"<<endl;
       cout<<"   ------------------------------------------------"<<endl;
       float sum=0;
        for(int i=0;i<count2;i++)
       {
          sum=sum+shopping_list[i].get_cost();
       }
       for(int i=0;i<count2;i++)
       {
          shopping_list[i].display();
       }
       cout<<"  "<<endl;
       cout<<"\t\t\t   The total cost = "<<sum<<endl;

        if(permission()=="no")
            {break;}
    }

     else if(option==4)
    {
         int temp1,temp2;
         cout<<"----------------- Adding to bill ----------------"<<endl;
         cout<<"   Enter the item code       : ";
         cin>>temp1;
```

```
            cout<<"   Enter the number of items : ";
            cin>>temp2;
            for(int i=0;i<count1;i++)
            {
                if(temp1==shopping_list[i].get_code())
                {
                    if(temp1==inventory[i].get_code())
                    {

                        if(inventory[i].get_quantity()>=temp2)
                        {
                            shopping_list[i].add_item(temp2);
                            inventory[i].delete_item(temp2);
                            cout<<" "<<endl;
                            cout<<"   ------ Number of items increased ------"<<endl;
                            cout<<" "<<endl;

                        }
                         else
                        {
                            cout<<" "<<endl;
                            cout<<"   ------ The item is out of stock ------"<<endl;
                            cout<<" "<<endl;
                        }
                        verify=true;
                    }
                }
            }
            if(verify==false)
            {
                cout<<" "<<endl;
                cout<<"   ------- Invalid Item Code -------"<<endl;
                cout<<" "<<endl;
                verify=false;
            }


            if(permission()=="no")
               {break;}

        }
```

```
else if(option==5)
{
    int temp1,temp2;
    cout<<"----------------- Removing from bill ----------------"<<endl;
    cout<<"   Enter the item code       : ";
    cin>>temp1;
    cout<<"   Enter the number of items : ";
    cin>>temp2;
    for(int i=0;i<count1;i++)
     {
         if(temp1==shopping_list[i].get_code())
         {
             if(temp1==inventory[i].get_code())
             {

                 if(shopping_list[i].get_quantity()>=temp2)
                 {
                     shopping_list[i].delete_item(temp2);
                     inventory[i].add_item(temp2);
                     cout<<" "<<endl;
                     cout<<"   ------ Number of items decreased ------"<<endl;
                     cout<<" "<<endl;

                 }
                  else
                 {
                     cout<<" "<<endl;
                     cout<<"   ------ Not that much item in bill ------"<<endl;
                     cout<<" "<<endl;
                 }
                 verify=true;
             }
         }
     }
    if(verify==false)
    {
         cout<<" "<<endl;
         cout<<"   ------- Invalid Item Code -------"<<endl;
         cout<<" "<<endl;
          verify=false;
```

```
        }


        if(permission()=="no")
           {break;}

    }
     else if(option==6)
    {
        int temp1,temp2;
        cout<<"----------------- Removing from stock ----------------"<<endl;
        cout<<"   Enter the item code       : ";
        cin>>temp1;
        cout<<"   Enter the number of items : ";
        cin>>temp2;
        for(int i=0;i<count1;i++)
        {

            if(temp1==inventory[i].get_code())
            {
                if(inventory[i].get_quantity()>=temp2)
                {
                    inventory[i].delete_item(temp2);
                    cout<<" "<<endl;
                    cout<<"   ------- Removed from stock -------"<<endl;
                    cout<<" "<<endl;


                }
                else
                {
                 cout<<" "<<endl;
                 cout<<"   ------ The item is out of stock ------"<<endl;
                 cout<<" "<<endl;
                }
                verify=true;

            }
         }
        if(verify==false)
        {
```

```
            cout<<" "<<endl;
            cout<<"   ------- Invalid Item Code -------"<<endl;
            cout<<" "<<endl;
            verify=false;

        }


        if(permission()=="no")
           {break;}

    }
     else if(option==7)
    {
        int temp;
        cout<<"----------------- Removing from inventory ----------------"<<endl;
        cout<<"   Enter the item code       : ";
        cin>>temp;
        for(int i=0;i<count1;i++)
        {
            if(temp==inventory[i].get_code())
            {

                    for(int j=i;j<count1;j++)
                    {
                     inventory[j]=inventory[j+1];
                    }
                    verify=true;
                    count1=count1-1;
                    cout<<" "<<endl;
                    cout<<"   ------- Product Removed -------"<<endl;
                    cout<<" "<<endl;
            }
         }
        if(verify==false)
        {
            cout<<" "<<endl;
            cout<<"   ------- Invalid Item Code -------"<<endl;
            cout<<" "<<endl;
            verify=false;
```

```
        }


        if(permission()=="no")
           {break;}

    }
     else if(option==8)
    {
        int temp;
        cout<<"----------------- Returning a product ----------------"<<endl;
        cout<<"   Enter the item code       : ";
        cin>>temp;
        for(int i=0;i<count2;i++)
        {
            if(temp==shopping_list[i].get_code())
            {
                int x;
                x=shopping_list[i].get_quantity();

                for(int i=0;i<count1;i++)
                {
                    if(temp==inventory[i].get_code())
                    {
                        inventory[i].add_item(x);
                    }
                }
                 for(int j=i;j<count2;j++)
                {
                     shopping_list[j]=shopping_list[j+1];
                }
                    verify=true;
                    count2=count2-1;


               cout<<" "<<endl;
               cout<<"   ------- Product Returned -------"<<endl;
               cout<<" "<<endl;

             }
         }
```

```
        if(verify==false)
        {
             cout<<" "<<endl;
             cout<<"   ------- Invalid Item Code -------"<<endl;
             cout<<" "<<endl;
             verify=false;

        }


        if(permission()=="no")
           {break;}

    }
    else if(option==9)
    {
       float sum=0;
       cout<<"---------------------- BILL ----------------------"<<endl;
       for(int i=0;i<count2;i++)
       {
          sum=sum+shopping_list[i].get_cost();
       }
       cout<<"   NAME"<<"\t\tCODE"<<"\tNUMBER"<<"\tPRICE"<<endl;
       cout<<"   -------------------------------------------------"<<endl;
       for(int i=0;i<count2;i++)
       {
          shopping_list[i].display();
       }
       cout<<"  "<<endl;
       cout<<"\t\t\t   The total bill = "<<sum<<endl;
       if(permission()=="no")
          {break;}
    }
    else if(option==10)
    {
       float sum=0;
       cout<<"----------------- List of Products ----------------"<<endl;
       for(int i=0;i<count1;i++)
       {
          sum=sum+inventory[i].get_cost();
       }
```

```
            cout<<"   NAME"<<"\t\tCODE"<<"\tNUMBER"<<"\tPRICE"<<endl;
            cout<<"   ------------------------------------------------"<<endl;
            for(int i=0;i<count1;i++)
            {
               inventory[i].display();
            }

            if(permission()=="no")
               {break;}
         }
         else if(option==11)
         {
             break;
         }
         else
         {
             cout<<"  "<<endl;
             cout<<"   -------------- Invalid Entry -------------"<<endl;
             cout<<"  "<<endl;
         }


}cout<<"                     -------------- Thank You -------------"<<endl;

return 0;
}
```

SAMPLE INPUT-OUTPUT

```
   ============ INVENTORY ==============

   Choose any of the following option to continue
-------------------------------------------------
    1  to enter a new product to the inventory
    2  to add an item to the stock
    3  to purchase a product
    4  to increase the number of items purchased
    5  to decrease the number of items purchased
    6  to remove an item from the stock
    7  to remove a product from the inventory
    8  to return a product
    9  to get the bill of items
    10 to get the list of items
    11 to exit from the program
 :--1
------------------New Product----------------
   Enter the name of the item  : Pen
   Enter the item code         : 1
   Enter the item price        : 10
   Enter the number of items   : 5

   ------ New product added ------

   Enter 1 to continue adding new products or 0 to print the list
:--1
------------------New Product----------------
   Enter the name of the item  : Book
   Enter the item code         : 2
   Enter the item price        : 5
   Enter the number of items   : 10

   ------ New product added ------

   Enter 1 to continue adding new products or 0 to print the list
:--0
----------------- List of Products ----------------
   NAME         CODE    NUMBER  PRICE
   -------------------------------------------------
   Pen          1       5       10
   Book         2       10      5
```

```
   Do you want to continue ?
           yes or no?
:--yes
   ============ INVENTORY ==============

   Choose any of the following option to continue
-------------------------------------------------
    1  to enter a new product to the inventory
    2  to add an item to the stock
    3  to purchase a product
    4  to increase the number of items purchased
    5  to decrease the number of items purchased
    6  to remove an item from the stock
    7  to remove a product from the inventory
    8  to return a product
    9  to get the bill of items
    10 to get the list of items
    11 to exit from the program
 :--2
----------------- Adding to stock----------------
   Enter the item code       : 1
   Enter the number of items : 5

   ------ Number of items increased ------


   Do you want to continue ?
           yes or no?
:--yes
```

```
   ============ INVENTORY ==============

   Choose any of the following option to continue
-------------------------------------------------
    1  to enter a new product to the inventory
    2  to add an item to the stock
    3  to purchase a product
    4  to increase the number of items purchased
    5  to decrease the number of items purchased
    6  to remove an item from the stock
    7  to remove a product from the inventory
    8  to return a product
    9  to get the bill of items
    10 to get the list of items
    11 to exit from the program
 :--3
----------------- Purchase ----------------
   Enter the item code       : 1
   Enter the number of items : 3

   ------ Purchased product added to the bill ------

   Enter 1 to continue purchasing new products or 0 to print the bill
:--1
----------------- Purchase ----------------
   Enter the item code       : 2
   Enter the number of items : 4

   ------ Purchased product added to the bill ------

   Enter 1 to continue purchasing new products or 0 to print the bill
:--0
   ---------------------- BILL ----------------------
   NAME         CODE    NUMBER  PRICE
   -------------------------------------------------
   Pen          1       3       10
   Book         2       4       5

                           The total cost = 50

   Do you want to continue ?
           yes or no?
:--no
                    -------------- Thank You -------------
```

SWAP PRIVATE DATA MEMBERS

AIM

Write a Program to swap private data members of classes named as class_1, class_2 using friend function

PROGRAM

```
#include <iostream>

using namespace std;

class class_2;

class class_1
{
    int data;

public:

    class_1(int x)
    {
        data=x;
    }

void display();
friend void swap_pri(class_1 &,class_2 &);
};

void class_1::display()
{
    cout<<"   Private data member of class_1 : "<<data<<endl;
}

class class_2
{
   int data;

public:

    class_2(int x)
```

```
    {
        data=x;
    }

void display();
friend void swap_pri(class_1 &,class_2 &);
};

void class_2::display()
{
    cout<<"   Private data member of class_2 : "<<data<<endl;
}

void swap_pri(class_1 &x,class_2 &y)
{
int temp;
temp = x.data;
x.data = y.data;
y.data = temp;
}

int main()
{
    int option=6;
    int x;
    cout<<"     Program to swap private data members "<<endl;
    cout<<"    ------------------------------------ "<<endl;

    while(option==6)
    {
        cout<<" "<<endl;
        cout<<"   Enter the private data member of class_1 : ";
        cin>>x;
        class_1 obj1(x);
        cout<<" "<<endl;

        cout<<"   Enter the private data member of class_2 : ";
        cin>>x;
        class_2 obj2(x);
        cout<<" "<<endl;
```

```
        cout<<"   Data before swapping : "<<endl;
        cout<<" "<<endl;
        obj1.display();
        obj2.display();
        swap_pri(obj1,obj2);
        cout<<" "<<endl;

        cout<<"   Data after swapping : "<<endl;
        cout<<" "<<endl;
        obj1.display();
        obj2.display();
        cout<<" "<<endl;

        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
        cout<<":--";
        cin>>option;
        cout<<" "<<endl;
    }
    cout<<"               ---------- Thank You -----------"<<endl;
    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
    Program to swap private data members
   -------------------------------------

  Enter the private data member of class_1 : 3

  Enter the private data member of class_2 : 6

  Data before swapping :

  Private data member of class_1 : 3
  Private data member of class_2 : 6

  Data after swapping :

  Private data member of class_1 : 6
  Private data member of class_2 : 3

             Would you like to continue ?
  Enter 6 to continue or any other number to end the program
:--9

             ---------- Thank You -----------
```

COMPLEX CLASS

AIM

Program to design a class complex to represent complex numbers. The complex class should use an external function (use it as a friend function) to add two complex numbers. The function should return an object of type complex representing the sum of two complex numbers

PROGRAM

```
#include <iostream>

using namespace std;

class Complex
{
    float real;
    float imag;

public:

    Complex(void)
    {
    }

    Complex(float x, float y)
    {
        real = x;
        imag = y;
    }

    void display(void)
    {
        if (imag >= 0)
        {cout<<"("<<real<<" + "<<imag<<"i"<<")";}
        else
        {cout<<"("<<real<<" - "<<(-1)*imag<<"i"<<")";}

    }

    friend Complex add(Complex,Complex);
```

```
};

Complex add(Complex C1,Complex C2)
{
    Complex temp;
    temp.real = C1.real+C2.real;
    temp.imag = C1.imag+C2.imag;
    return temp;
}

int main()
{
    cout<<"          Program to add two complex numbers "<<endl;
    cout<<"         ------------------------------------"<<endl;
    int option=6;
    int x,y;

    while(option==6)
    {
        cout<<" "<<endl;
        cout<<"   Enter the real part of Complex Number-1   : ";
        cin>>x;
        cout<<"   Enter imaginary part of  Complex Number-1 : ";
        cin>>y;
        Complex c1(x,y);
        cout<<" "<<endl;
        cout<<"   Enter the real part of Complex Number-2   : ";
        cin>>x;
        cout<<"   Enter imaginary part of  Complex Number-2 : ";
        cin>>y;
        Complex c2(x,y);
        Complex c3;
        c3=add(c1,c2);
        cout<<" "<<endl;
        cout<<"   ";c1.display();cout<<" + ";c2.display();cout<<" = ";c3.display();
        cout<<" "<<endl;
        cout<<" "<<endl;

        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
        cout<<":--";
```

```
        cin>>option;
        cout<<" "<<endl;

    }
    cout<<"              ---------- Thank You -----------"<<endl;
    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
          Program to add two complex numbers
         -----------------------------------

   Enter the real part of Complex Number-1   : 3
   Enter imaginary part of  Complex Number-1 : -6

   Enter the real part of Complex Number-2   : -1
   Enter imaginary part of  Complex Number-2 : 2

   (3 - 6i) + (-1 + 2i) = (2 - 4i)

               Would you like to continue ?
   Enter 6 to continue or any other number to end the program
:--3

              ---------- Thank You -----------
```

OPERATOR OVERLOADING FOR VECTOR CLASS

AIM

Write a C++ program to overload ==, ! =, <, <=, > and >= operators as member operator functions for a vector object.

PROGRAM

```
#include <iostream>
#include <cmath>

using namespace std;

class Vector
{
    int x,y,z;
    float magnitude;

public:

    Vector()
    {
        x=0;
        y=0;
        z=0;
    }
    void input(void);
    void display(void);
    int operator ==(Vector);
    int operator !=(Vector);
    int operator >=(Vector);
    int operator <=(Vector);
    int operator  >(Vector);
    int operator  <(Vector);
};

void Vector::input()
{
    cout<<"   Enter the x coordinate : ";
    cin>>x;
    cout<<"   Enter the y coordinate : ";
```

```
    cin>>y;
    cout<<"   Enter the z coordinate : ";
    cin>>z;
    magnitude=pow(x,2)+pow(y,2)+pow(z,2);
    magnitude=pow(magnitude,0.5);
    cout<<" "<<endl;
    cout<<"   Magnitude = "<<magnitude<<endl;
}

void Vector::display()
{
    cout<<x<<" "<<y<<" "<<z;
}

int Vector::operator==(Vector v)
{
    if(magnitude==v.magnitude)return(1);
    else return(0);
}

int Vector::operator!=(Vector v)
{
    if(magnitude!=v.magnitude)return(1);
    else return(0);
}

int Vector::operator>=(Vector v)
{
    if(magnitude>=v.magnitude)return(1);
    else return(0);
}

int Vector::operator<=(Vector v)
{
    if(magnitude<=v.magnitude)return(1);
    else return(0);
}

int Vector::operator>(Vector v)
{
    if(magnitude>v.magnitude)return(1);
```

```
    else return(0);
}

int Vector::operator<(Vector v)
{
    if(magnitude<v.magnitude)return(1);
    else return(0);
}

int main()
{
    cout<<"               Program to compare two vectors "<<endl;
    cout<<"              --------------------------------"<<endl;
    Vector V1,V2;
    int option=6;

    while(option==6)
    {
        cout<<" "<<endl;
        cout<<"-------------------------------------"<<endl;
        cout<<"   Enter vector-1 : "<<endl;
        cout<<" "<<endl;
        V1.input();
        cout<<"-------------------------------------"<<endl;
        cout<<" "<<endl;

        cout<<"-------------------------------------"<<endl;
        cout<<"   Enter vector-2 : "<<endl;
        cout<<" "<<endl;
        V2.input();
        cout<<"-------------------------------------"<<endl;
        cout<<" "<<endl;

        if(V1==V2)
        {
            cout<<"   | ";
            V1.display();
            cout<<" |";
            cout<<" == ";
            cout<<"| ";
            V2.display();
```

```
        cout<<" |"<<endl;
        cout<<" "<<endl;

        cout<<"   | ";
        V1.display();
        cout<<" |";
        cout<<" >= ";
        cout<<"| ";
        V2.display();
        cout<<" |"<<endl;
        cout<<" "<<endl;

        cout<<"   | ";
        V1.display();
        cout<<" |";
        cout<<" <= ";
        cout<<"| ";
        V2.display();
        cout<<" |"<<endl;
    }

    else if(V1!=V2)
    {
        cout<<"   | ";
        V1.display();
        cout<<" |";
        cout<<" != ";
        cout<<"| ";
        V2.display();
        cout<<" |"<<endl;
        cout<<" "<<endl;

         if(V1>V2)
         {
            cout<<"   | ";
            V1.display();
            cout<<" |";
            cout<<" >  ";
            cout<<"| ";
            V2.display();
            cout<<" |"<<endl;}
```

```
    else if(V1<V2)
    {
        cout<<"   | ";
        V1.display();
        cout<<" |";
        cout<<" <  ";
        cout<<"| ";
        V2.display();
        cout<<" |"<<endl;
        cout<<" "<<endl;
    }

    if(V1>=V2)
    {
       cout<<"   | ";
       V1.display();
       cout<<" |";
       cout<<" >= ";
       cout<<"| ";
       V2.display();
       cout<<" |"<<endl;
    }

    else if(V1<=V2)
    {
       cout<<"   | ";
       V1.display();
       cout<<" |";
       cout<<" <= ";
       cout<<"| ";
       V2.display();
       cout<<" |"<<endl;
    }
}


 cout<<" "<<endl;
 cout<<"                Would you like to continue ? "<<endl;
 cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
 cout<<":--";
```

```
          cin>>option;


 }
 cout<<"                  ---------- Thank You ----------"<<endl;
 return 0;
}
```

SAMPLE INPUT-OUTPUT

```
              Program to compare two vectors
             -------------------------------


-----------------------------------
   Enter vector-1 :

   Enter the x coordinate : 1
   Enter the y coordinate : 2
   Enter the z coordinate : 3

   Magnitude = 3.74166
-----------------------------------

-----------------------------------
   Enter vector-2 :

   Enter the x coordinate : 1
   Enter the y coordinate : 2
   Enter the z coordinate : 3

   Magnitude = 3.74166
-----------------------------------

   | 1 2 3 | == | 1 2 3 |

   | 1 2 3 | >= | 1 2 3 |

   | 1 2 3 | <= | 1 2 3 |

              Would you like to continue ?
   Enter 6 to continue or any other number to end the program
:--6


-----------------------------------
   Enter vector-1 :

   Enter the x coordinate : 2
   Enter the y coordinate : 3
   Enter the z coordinate : 4

   Magnitude = 5.38516
-----------------------------------

-----------------------------------
   Enter vector-2 :

   Enter the x coordinate : 3
   Enter the y coordinate : 5
   Enter the z coordinate : 7

   Magnitude = 9.11043
-----------------------------------

   | 2 3 4 | != | 3 5 7 |

   | 2 3 4 | <  | 3 5 7 |

   | 2 3 4 | <= | 3 5 7 |

              Would you like to continue ?
   Enter 6 to continue or any other number to end the program
:--9

               ---------- Thank You ----------
```

OVERLOAD OPERATORS FOR A COMPLEX CLASS

AIM

Write a C++ program to design a class representing complex numbers and having the functionality of performing addition & multiplication of two complex numbers using operator overloading (Use friend operator functions).

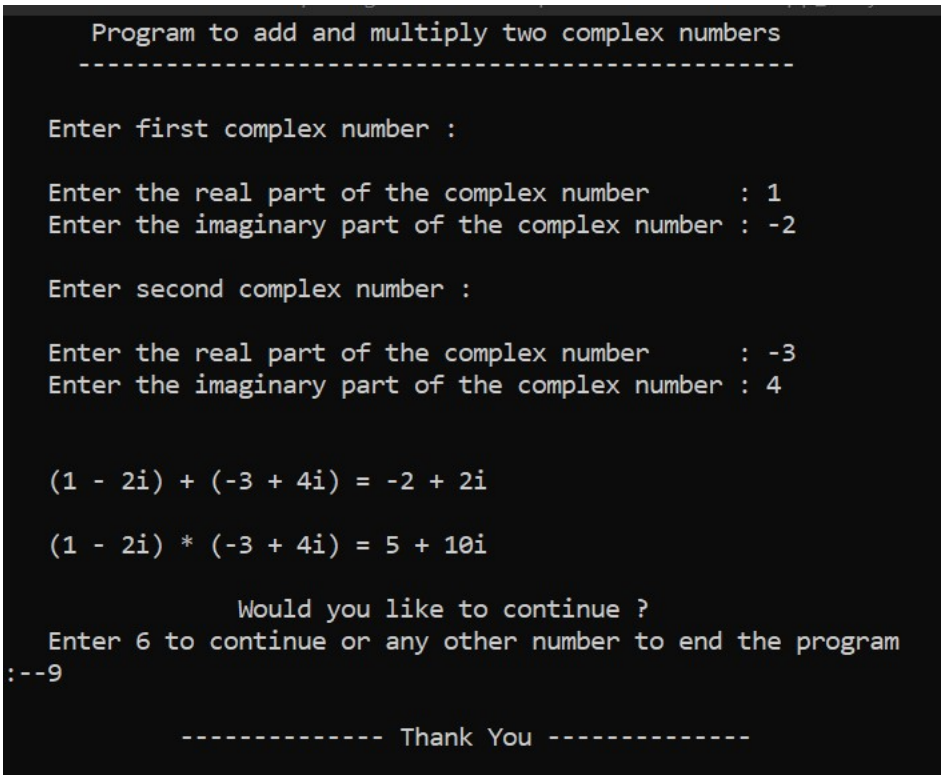
PROGRAM

```
#include <iostream>

using namespace std;

class Complex
{
    int real,imag;

public:

    Complex()
    {
        real=0;
        imag=0;
    }

    void input(void);
    void display(void);
    friend Complex operator+(Complex,Complex);
    friend Complex operator*(Complex,Complex);
};

void Complex::input(void)
{
    cout<<"   Enter the real part of the complex number      : ";
    cin>>real;
    cout<<"   Enter the imaginary part of the complex number : ";
    cin>>imag;
}

void Complex::display(void)
{
```

```
    if(imag>=0)
    {
        cout<<real<<" + "<<imag<<"i";
    }

    else
    {
        cout<<real<<" - "<<-1*imag<<"i";
    }
}

Complex operator+(Complex C1,Complex C2)
{
    Complex C3;
    C3.real=C1.real+C2.real;
    C3.imag=C1.imag+C2.imag;
    return C3;
}

Complex operator*(Complex C1,Complex C2)
{
    Complex C3;
    C3.real=((C1.real*C2.real)-(C1.imag*C2.imag));
    C3.imag=((C1.real*C2.imag)+(C1.imag*C2.real));
    return C3;
}

int main()
{
    cout<<"      Program to add and multiply two complex numbers "<<endl;
    cout<<"     ------------------------------------------------"<<endl;
    Complex c1,c2,c3,c4;
    int option=6;
    while(option==6)
    {
        cout<<" "<<endl;
        cout<<"   Enter first complex number : "<<endl;
        cout<<" "<<endl;
        c1.input();
        cout<<" "<<endl;
        cout<<"   Enter second complex number : "<<endl;
```

```
        cout<<" "<<endl;
        c2.input();
        cout<<" "<<endl;


        c3=c1+c2;
        cout<<" "<<endl;
        cout<<"   (";c1.display();cout<<")";cout<<" + ";cout<<"(";
        c2.display();cout<<")";cout<<" = ";c3.display();
        cout<<" "<<endl;


        c3=c1*c2;
        cout<<" "<<endl;
        cout<<"   (";c1.display();cout<<")";cout<<" * ";cout<<"(";
        c2.display();cout<<")";cout<<" = ";c3.display();


        cout<<" "<<endl;
        cout<<" "<<endl;
        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
        cout<<":--";
        cin>>option;
        cout<<" "<<endl;
    }
    cout<<"            -------------- Thank You --------------"<<endl;

    return 0;
}
```

SAMPLE INPUT-OUTPUT



OPERATOR OVERLOADING FOR VECTOR CLASS

AIM

Write a C++ program to overload operators like $*$, $<<$, $>>$ using friend function. The following overloaded operators should work for a class vector

PROGRAM

```
#include <iostream>

using namespace std;

class Vector
{
    int v[3];

public:

    Vector();
    friend int operator *(Vector,Vector);
    friend istream & operator >> (istream &,Vector &);
    friend ostream & operator << (ostream &,Vector &);
};

 Vector::Vector()
{
  for(int i=0;i<3;i++)
  {v[i]=0;}
}

istream & operator >> (istream &vin,Vector &V)
{
  for(int i=0;i<3;i++)
  {
      vin>>V.v[i];
  }
  return (vin);
}

ostream & operator <<(ostream& vout,Vector& V)
{
```

```
    vout<<"[ ";
    for(int i=0;i<3;i++)
    {
        vout<<V.v[i]<<" ";
    }
    vout<<"]";
    return (vout);
}

int operator *(Vector V1,Vector V2)
{
    int temp=0;
    for(int i=0;i<3;i++)
    {
     temp=temp+V1.v[i]*V2.v[i];
    }
    return temp;
}

int main()
{
    cout<<"     Program to carry out dot product of two vectors "<<endl;
    cout<<"    ------------------------------------------------"<<endl;
    Vector v1,v2;
    int temp,option=6;
    int scale;

    while(option==6)
    {

        cout<<" "<<endl;
        cout<<"   Enter the first vector  : ";
        cin>>v1;
        cout<<" "<<endl;
        cout<<"   Vector-1 : ";
        cout<<v1;
        cout<<" "<<endl;
        cout<<" "<<endl;

        cout<<"   Enter the second vector : ";
        cin>>v2;
```

```
        cout<<" "<<endl;
        cout<<"   Vector-2 : ";
        cout<<v2;
        cout<<" "<<endl;
        cout<<" "<<endl;

        temp=v1*v2;
        cout<<"   The dot product of the two vectors is "<<temp<<endl;
        cout<<" "<<endl;


        cout<<" "<<endl;
        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
        cout<<":--";
        cin>>option;
        cout<<" "<<endl;
    }
cout<<"             --------- Thank You ---------"<<endl;
    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
    Program to carry out dot product of two vectors
   ------------------------------------------------

  Enter the first vector  : 3 4 5

  Vector-1 : [ 3 4 5 ]

  Enter the second vector : 3 6 9

  Vector-2 : [ 3 6 9 ]

  The dot product of the two vectors is 78


             Would you like to continue ?
  Enter 6 to continue or any other number to end the program
:--3

            --------- Thank You ---------
```

OPERATOR OVERLOADING FOR MATRIX CLASS

AIM

Write a C++ program for developing a matrix class which can handle integer matrices of different dimensions. Also overload the operator for addition and multiplication of matrices. Use double pointers in your program to dynamically allocate memory for the matrices.

PROGRAM

```
#include <iostream>

using namespace std;

class matrix
{
    int row,col;
    int**m;

public:

    matrix(int,int);
    ~matrix();
    void input(void);
    void display(void);
    matrix operator + (matrix &);
    matrix operator * (matrix &);
};

matrix::matrix(int x,int y)
{
    row=x;
    col=y;
    m=new int*[row];
    for(int i=0;i<row;i++)
    {
        m[i]=new int[col];
    }
}

matrix::~matrix()
{
```

```
    for(int i=0;i<row;i++)
    {delete m[i];}
    delete m;
}

void matrix::input()
{
    for(int i=0;i<row;i++)
    {
        for(int j=0;j<col;j++)
        {
            cout<<"   m"<<"("<<i+1<<j+1<<")"<<"=";
            cin>>m[i][j];
        }
        cout<<" "<<endl;
    }
}

void matrix::display()
{
    for(int i=0;i<row;i++)
    {
        cout<<"   ";
        for(int j=0;j<col;j++)
        {
            cout<<m[i][j]<<" ";
        }
        cout<<" "<<endl;
    }
}

matrix matrix::operator + (matrix &M)
{
        matrix temp(row,col);
        for(int i=0;i<row;i++)
        {
            for(int j=0;j<col;j++)
            {
                temp.m[i][j]=m[i][j] + M.m[i][j];
            }
        }
```

```
    return temp;
}

matrix matrix:: operator * (matrix &M)
 {
    matrix temp(row,M.col);
    for(int i=0;i<row;i++)
    {
        for(int j=0;j<M.col;j++)
        {
            temp.m[i][j]=0;

            for(int k=0;k<col;k++)
            {
                temp.m[i][j]= temp.m[i][j]+ m[i][k]*M.m[k][j];
            }
        }
    }
    return temp;
 }

int main()
{
    cout<<"        Program to add and multiply two matrices "<<endl;
    cout<<"       ----------------------------------------"<<endl;
    int w,x,y,z;
    int option=6;
    while(option==6)
    {
        cout<<" "<<endl;
        cout<<"   Enter the number of rows of the Matrix-1    : ";
        cin>>x;
        cout<<"   Enter the number of columns of the Matrix-1 : ";
        cin>>y;
        cout<<" "<<endl;
         matrix m1(x,y);
        cout<<" "<<endl;

        cout<<"   Enter the elements of matrix-1 : "<<endl;
        cout<<" "<<endl;
        m1.input();
```

```
cout<<"   Matrix-1 :"<<endl;
cout<<" "<<endl;
m1.display();
cout<<" "<<endl;

cout<<"   Enter the number of rows of the Matrix-2    : ";
cin>>w;
cout<<"   Enter the number of columns of the Matrix-2 : ";
cin>>z;
matrix m2(w,z);
cout<<" "<<endl;

cout<<"   Enter the elements of matrix-2 : "<<endl;
cout<<" "<<endl;
m2.input();
cout<<"   Matrix-2 : "<<endl;
cout<<" "<<endl;
m2.display();
cout<<" "<<endl;

if(x==w && y==z)
{
    matrix m3(x,y);
    m3=m1+m2;
    cout<<"   Matrix-1 + Matrix-2 = Matrix-3 "<<endl;
    cout<<" "<<endl;
    cout<<"   Matrix-3 : "<<endl;
    cout<<" "<<endl;
    m3.display();
}

else
{
    cout<<" "<<endl;
    cout<<"   Addition cannot be performed as number of rows
    and columns are not matching "<<endl;
    cout<<" "<<endl;
}

if(y==w)
{
```

```
        matrix m4(x,z);
        m4=m1*m2;
        cout<<"   Matrix-1 x Matrix-2 = Matrix-4 "<<endl;
        cout<<" "<<endl;
        cout<<"   Matrix-4 : "<<endl;
        cout<<" "<<endl;
        m4.display();

        }
        else
        {
            cout<<" "<<endl;
            cout<<"   Multiplication cannot be performed as number of rows
            and columns are not matching "<<endl;
            cout<<" "<<endl;
        }

        cout<<" "<<endl;
        cout<<"                Would you like to continue ? "<<endl;
        cout<<"   Enter 6 to continue or any other number to end the program"<<endl;
        cout<<":--";
        cin>>option;
        cout<<" "<<endl;
    }
    cout<<"            -------- Thank You ---------"<<endl;

    return 0;
}
```

SAMPLE INPUT-OUTPUT

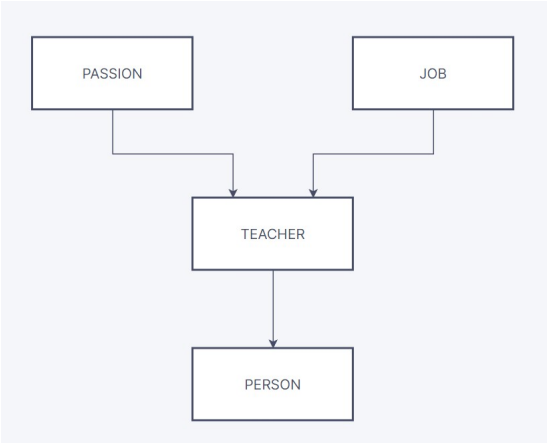
```
       Program to add and multiply two matrices
      ----------------------------------------

  Enter the number of rows of the Matrix-1    : 3
  Enter the number of columns of the Matrix-1 : 3


  Enter the elements of matrix-1 :

  m(11)=1
  m(12)=3
  m(13)=1

  m(21)=1
  m(22)=2
  m(23)=0

  m(31)=4
  m(32)=3
  m(33)=2

  Matrix-1 :

  1 3 1
  1 2 0
  4 3 2

  Enter the number of rows of the Matrix-2    : 3
  Enter the number of columns of the Matrix-2 : 3

  Enter the elements of matrix-2 :

  m(11)=1
  m(12)=0
  m(13)=0

  m(21)=0
  m(22)=1
  m(23)=0

  m(31)=0
  m(32)=0
  m(33)=1

  Matrix-2 :

  1 0 0
  0 1 0
  0 0 1

  Matrix-1 + Matrix-2 = Matrix-3

  Matrix-3 :

  2 3 1
  1 3 0
  4 3 3
  Matrix-1 x Matrix-2 = Matrix-4

  Matrix-4 :

  1 3 1
  1 2 0
  4 3 2

             Would you like to continue ?
  Enter 6 to continue or any other number to end the program
:--3

          -------- Thank You ---------
```

MULTIPLE AND MULTILEVEL INHERITANCE

AIM

Write a C++ program to demonstrate the concept of Multiple and Multilevel inheritance including constructors with parameters

INHERITANCE DIAGRAM



PROGRAM

```
#include <iostream>

using namespace std;

class passion
{
protected:

    string pass;

public:
    passion(string s )
    {
        pass=s;
    }

    void show_pass(void)
    {
        cout<<"   Passion : "<<pass<<endl;
    }
};
```

```
class job
{
protected:
    string j_name;
    float salary;

public:

    job(string y,float x)
    {
        salary=x;
        j_name=y;
    }

    void show_salary(void)
    {
       cout<<"   Job     : "<<j_name<<endl;
       cout<<"   Salary  : "<<salary<<endl;
    }

};

class teacher:public job,public passion
{
protected:
    string subject;

public:

    teacher(string s,string y,float x,string z):job(y,x),passion(z)
    {
        subject=s;
    }

    void show_sub(void)
    {
       cout<<"   Subject : "<<subject<<endl;
    }
};
```

```
class person:public teacher
{
    string name;
    int age;

public:

    person (string s,int x,string t,string y,float v,string z):teacher(t,y,v,z)
    {
        name=s;
        age=x;
    }

    void show(void)
    {
        cout<<"   Name    : "<<name<<endl;
        cout<<"   Age     : "<<age<<endl;
    }

};

int main()
{
    string a,b,c,d;
    int x;
    float y;

    cout<<"    Program to print basic details of teachers "<<endl;
    cout<<"   ------------------------------------------"<<endl;
    cout<<" "<<endl;
    cout<<"   Enter your name     : ";
    cin>>a;
    cout<<"   Enter your age      : ";
    cin>>x;
    cout<<"   Enter your job      : ";
    cin>>b;
    cout<<"   Enter your passion  : ";
    cin>>c;
    cout<<"   Enter your salary   : ";
    cin>>y;
    cout<<"   Enter your subject  : ";
```

```
    cin>>d;
    cout<<" "<<endl;

    person p1(a,x,d,b,y,c);
    cout<<"--------- Basic Details ---------"<<endl;
    p1.show();
    p1.show_pass();
    p1.show_salary();
    p1.show_sub();
    cout<<" "<<endl;
    cout<<"      -------------- Thank You --------------"<<endl;

    return 0;
}
```

SAMPLE INPUT-OUTPUT

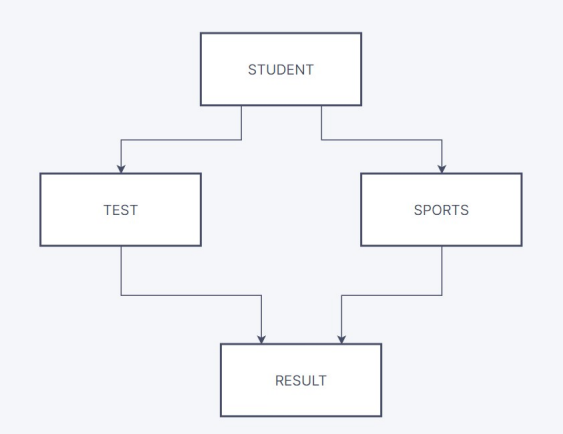
```
   Program to print basic details of teachers
  ------------------------------------------

  Enter your name     : Loona
  Enter your age      : 48
  Enter your job      : TGT
  Enter your passion  : Teaching
  Enter your salary   : 56000
  Enter your subject  : English

--------- Basic Details ---------
  Name    : Loona
  Age     : 48
  Passion : Teaching
  Job     : TGT
  Salary  : 56000
  Subject : English

     -------------- Thank You --------------
```

VIRTUAL BASE CLASS

AIM

Write a C++ program to design a student class representing student roll no. and a test class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sports and test class should be inherited by a result class having the functionality to add the scores and display the final result for a student. Demonstrate the concept of Virtual base class on Hybrid inheritance.

INHERITANCE DIAGRAM



PROGRAM

```
#include <iostream>

using namespace std;

class student
{
protected:

    int roll_number;

public:

    void input_roll(int x)
    {
        roll_number=x;
    }

    void display_roll(void)
```

```
    {
        cout<<"   Roll Number : "<<roll_number<<endl;
    }

};
class test : virtual public student
{
protected:

    float oop,ct4ps,maths;

public:

    void get_marks(float x,float y,float z)
    {
        oop=x;
        ct4ps=y;
        maths=z;
    }

    void display_marks(void)
    {
        cout<<"      SUBJECT REPORT "<<endl;
        cout<<"   Marks in oop     : "<<oop<<endl;
        cout<<"   Marks in ct4ps   : "<<ct4ps<<endl;
        cout<<"   Marks in maths   : "<<maths<<endl;
    }
};
class sports: virtual public student
{
protected:

     float football;
     float batminton;

public:

    void get_grade(float x,float y)
    {
        football=x;
        batminton=y;
```

```
    }

    void display_grade(void)
    {
        cout<<"      SPORTS REPORT"<<endl;
        cout<<"   Score of football match  : "<<football<<endl;
        cout<<"   Score of batminton match : "<<batminton<<endl;
    }
};

class result : public test,public sports
{
    float average;

public:

    void display(void)
    {
        average= (oop+ct4ps+maths+football+batminton)/5;
        cout<<"      TOTAL REPORT "<<endl;
        cout<<"   Average score : "<<average;
    }

};



int main()
{
    float a,b,c,d,e;
    int x;
    result stu1;
    cout<<"      Program to print student report card "<<endl;
    cout<<"     ------------------------------------"<<endl;
    cout<<" "<<endl;
    cout<<"   Enter the roll number              : ";
    cin>>x;
    cout<<" "<<endl;
    cout<<"   Enter the marks in oop             : ";
    cin>>a;
    cout<<"   Enter the marks in ct4ps           : ";
```

```
    cin>>b;
    cout<<"   Enter the marks in maths           : ";
    cin>>c;
    cout<<" "<<endl;
    cout<<"   Enter the score of football match  : ";
    cin>>d;
    cout<<"   Enter the score of batminton match : ";
    cin>>e;
    cout<<" "<<endl;

    stu1.input_roll(x);
    stu1.get_marks(a,b,c);
    stu1.get_grade(d,e);

    cout<<"   --------- Student Report Card ---------"<<endl;
    cout<<" "<<endl;
    stu1.display_roll();
    cout<<" "<<endl;
    stu1.display_marks();
    cout<<" "<<endl;
    stu1.display_grade();
    cout<<" "<<endl;
    stu1.display();
    cout<<" "<<endl;
    cout<<" "<<endl;
    cout<<"   ------------ Thank You ------------"<<endl;

    return 0;

}
```

SAMPLE INPUT-OUTPUT

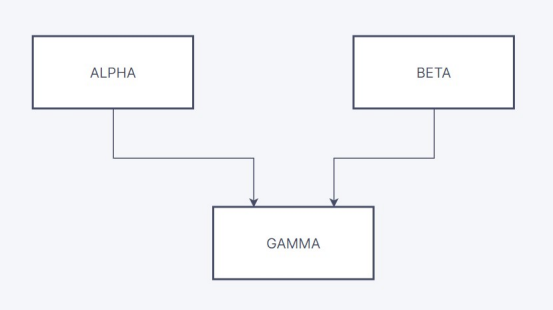
```
    Program to print student report card
   --------------------------------------

Enter the roll number              : 102

Enter the marks in oop             : 84
Enter the marks in ct4ps           : 88
Enter the marks in maths           : 85

Enter the score of football match  : 74
Enter the score of batminton match : 80

--------- Student Report Card ---------

Roll Number : 102

   SUBJECT REPORT
Marks in oop     : 84
Marks in ct4ps   : 88
Marks in maths   : 85

   SPORTS REPORT
Score of football match  : 74
Score of batminton match : 80

   TOTAL REPORT
Average score : 82.2

------------ Thank You ------------
```

CONSTRUCTORS DURING INHERITANCE

AIM

Write a C++ program illustrating how the constructors are implemented and the order in which they are called when the classes are inherited. Use three classes named alpha, beta and gamma such that alpha and beta are base classes and gamma is a derived class inheriting alpha & beta

INHERITANCE DIAGRAM



PROGRAM

```
# include <iostream>

using namespace std;

class alpha
{

    int data1;
    float data2;

public:

    alpha(int x,float y)
    {
        data1=x;
        data2=y;
        cout<<" "<<endl;
        cout<<"   --------- alpha constructor initialized ---------"<<endl;
        cout<<" "<<endl;
    }
    void display_alpha(void)
```

```
    {
        cout<<"   Data1 of alpha = "<<data1<<endl;
        cout<<"   Data2 of alpha = "<<data2<<endl;
    }
};

class beta
{
    int data1;
    char data2;

public:

    beta(int x,char y)
    {
        data1=x;
        data2=y;
        cout<<" "<<endl;
        cout<<"   --------- beta constructor initialized ---------"<<endl;
        cout<<" "<<endl;

    }

    void display_beta(void)
    {
         cout<<"   Data1 of beta = "<<data1<<endl;
         cout<<"   Data2 of beta = "<<data2<<endl;
    }
};
class gamma:public alpha,public beta
{
    string data;

public:

    gamma(int x,int y,float w,char z,string v):alpha(x,w),beta(y,z)
    {
        data=v;
        cout<<" "<<endl;
        cout<<"   --------- gamma constructor initialized ---------"<<endl;
        cout<<" "<<endl;
```

```
    }
    void display_gamma(void)
    {
          cout<<"   Data of gamma = "<<data<<endl;
    }
};
int main()
{
    cout<<"   Program to show constructor initialization during inheritance "<<endl;
    cout<<"  ----------------------------------------------------------------"<<endl;
    cout<<" "<<endl;
    int x,y;
    float w;
    char z;
    string v;

    cout<<"   Enter data1 of alpha class (integer) : ";
    cin>>x;
    cout<<"   Enter data2 of alpha class (float)   : ";
    cin>>w;
    cout<<" "<<endl;
    cout<<"   Enter data1 of beta class (integer)  : ";
    cin>>y;
    cout<<"   Enter data2 of beta class(char)      : ";
    cin>>z;
    cout<<" "<<endl;
    cout<<"   Enter data of gamma class(string)    : ";
    cin>>v;

    gamma obj(x,y,w,z,v);
    obj.display_alpha();
    cout<<" "<<endl;
    obj.display_beta();
    cout<<" "<<endl;
    obj.display_gamma();
    cout<<" "<<endl;
    cout<<"   ---------------- Thank You ----------------"<<endl;

    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
 Program to show constructor initialization during inheritance
-----------------------------------------------------------------

 Enter data1 of alpha class (integer) : 6
 Enter data2 of alpha class (float)   : 3.14

 Enter data1 of beta class (integer)  : 3
 Enter data2 of beta class(char)      : N

 Enter data of gamma class(string)    : ENERGY

 --------- alpha constructor initialized ---------


 --------- beta constructor initialized ---------


 --------- gamma constructor initialized ---------

 Data1 of alpha = 6
 Data2 of alpha = 3.14

 Data1 of beta = 3
 Data2 of beta = N

 Data of gamma = ENERGY

 ---------------- Thank You ----------------
```

RUN TIME POLYMORPHISM

AIM

Write a C++ program to define classes Shapes, Circle, Square, Ellipse and Rectangle with member functions to get the values for finding corresponding areas and print the same. Utilize the concept of Abstract Class and Run time polymorphism to solve the problem.

PROGRAM

```
#include <iostream>
#include <cstring>

using namespace std;

class shape
{
protected:

    float area;

public:

   virtual void input()=0;
   virtual void calculate()=0;
   virtual void display()=0;
};

class circle: public shape
{
  float radius;

public:

   void input(void)
   {
       cout<<"   Enter the radius of the circle : ";
     cin>>radius;
   }

   void calculate(void)
   {
```

```
        area=(3.14)*(radius*radius);
    }

    void display(void)
    {
        cout<<"   Area of the circle = "<<area<<endl;
    }
};

class rectangle: public shape
{
  float length;
  float breadth;

public:
    void input(void)
    {
        cout<<"   Enter the length of the rectangle : ";
        cin>>length;
        cout<<"   Enter the breadth of the rectangle : ";
        cin>>breadth;
    }

    void calculate(void)
    {
        area=length*breadth;
    }

    void display(void)
    {
        cout<<"   Area of the rectangle = "<<area<<endl;
    }
};

class ellipse: public shape
{
  float maj_axis;
  float min_axis;

public:
```

```
   void input(void)
   {
       cout<<"   Enter the major axis of the ellipse : ";
       cin>>maj_axis;
       cout<<"   Enter the minor axis of the ellipse : ";
       cin>>min_axis;
   }

   void calculate(void)
   {
       area=3.14*(maj_axis*min_axis);
   }

   void display(void)
   {
       cout<<"   Area of the ellipse = "<<area<<endl;
   }
};

class square: public shape
{
  float length;

public:

   void input(void)
   {
       cout<<"   Enter the length of the square : ";
       cin>>length;
   }

   void calculate(void)
   {
       area=length*length;
   }

   void display(void)
   {
       cout<<"   Area of the square = "<<area<<endl;
   }
};
```

```
int main()
{
    int option;
    shape* bptr;
    cout<<"        Program to calculate area of shapes "<<endl;
    cout<<"       ------------------------------------"<<endl;

    while(option!=5)
    {
        cout<<" "<<endl;
        cout<<"   Choose any of the following options to continue  "<<endl;
        cout<<"-------------------------------------------------"<<endl;
        cout<<"   1 to calculate the area of a circle    "<<endl;
        cout<<"   2 to calculate the area of a rectangle "<<endl;
        cout<<"   3 to calculate the area of a square    "<<endl;
        cout<<"   4 to calculate the area of a ellipse   "<<endl;
        cout<<"   5 to end the program                   "<<endl;
        cout<<":--";
        cin>>option;
        cout<<" "<<endl;

        if(option==1)
        {
        bptr=new circle;
        bptr->input();
        cout<<" "<<endl;
        bptr->calculate();
        bptr->display();
        cout<<" "<<endl;
        }

        else if(option==2)
        {
        bptr=new rectangle;
        bptr->input();
        cout<<" "<<endl;
        bptr->calculate();
        bptr->display();
        cout<<" "<<endl;
        }
```

```
         else if(option==3)
        {
        bptr=new square;
        bptr->input();
        cout<<" "<<endl;
        bptr->calculate();
        bptr->display();
        cout<<" "<<endl;
        }

        else if(option==4)
        {
        bptr=new ellipse;
        bptr->input();
        cout<<" "<<endl;
        bptr->calculate();
        bptr->display();
        cout<<" "<<endl;
        }

        else if(option==5)
        {
         break;
        }

        else
        {
            cout<<" "<<endl;
            cout<<"------------- Invalid Entry -------------"<<endl;
            cout<<" "<<endl;
        }
    }
    cout<<"       ---------------- Thank You ----------------"<<endl;
    return 0;
}
```

SAMPLE INPUT-OUTPUT

```
        Program to calculate area of shapes
       -------------------------------------

   Choose any of the following options to continue
-----------------------------------------------------
   1 to calculate the area of a circle
   2 to calculate the area of a rectangle
   3 to calculate the area of a square
   4 to calculate the area of a ellipse
   5 to end the program
:--1

   Enter the radius of the circle : 3

   Area of the circle = 28.26


   Choose any of the following options to continue
-----------------------------------------------------
   1 to calculate the area of a circle
   2 to calculate the area of a rectangle
   3 to calculate the area of a square
   4 to calculate the area of a ellipse
   5 to end the program
:--2

   Enter the length of the rectangle : 4
   Enter the breadth of the rectangle : 8

   Area of the rectangle = 32


   Choose any of the following options to continue
-----------------------------------------------------
   1 to calculate the area of a circle
   2 to calculate the area of a rectangle
   3 to calculate the area of a square
   4 to calculate the area of a ellipse
   5 to end the program
:--3

   Enter the length of the square : 6

   Area of the square = 36


   Choose any of the following options to continue
-----------------------------------------------------
   1 to calculate the area of a circle
   2 to calculate the area of a rectangle
   3 to calculate the area of a square
   4 to calculate the area of a ellipse
   5 to end the program
:--4

   Enter the major axis of the ellipse : 6
   Enter the minor axis of the ellipse : 9

   Area of the ellipse = 169.56


   Choose any of the following options to continue
-----------------------------------------------------
   1 to calculate the area of a circle
   2 to calculate the area of a rectangle
   3 to calculate the area of a square
   4 to calculate the area of a ellipse
   5 to end the program
:--5

       ---------------- Thank You ----------------
```

PURE VIRTUAL FUNCTION

AIM

Write a C++ program to demonstrate the use of pure virtual functions and abstract base classes

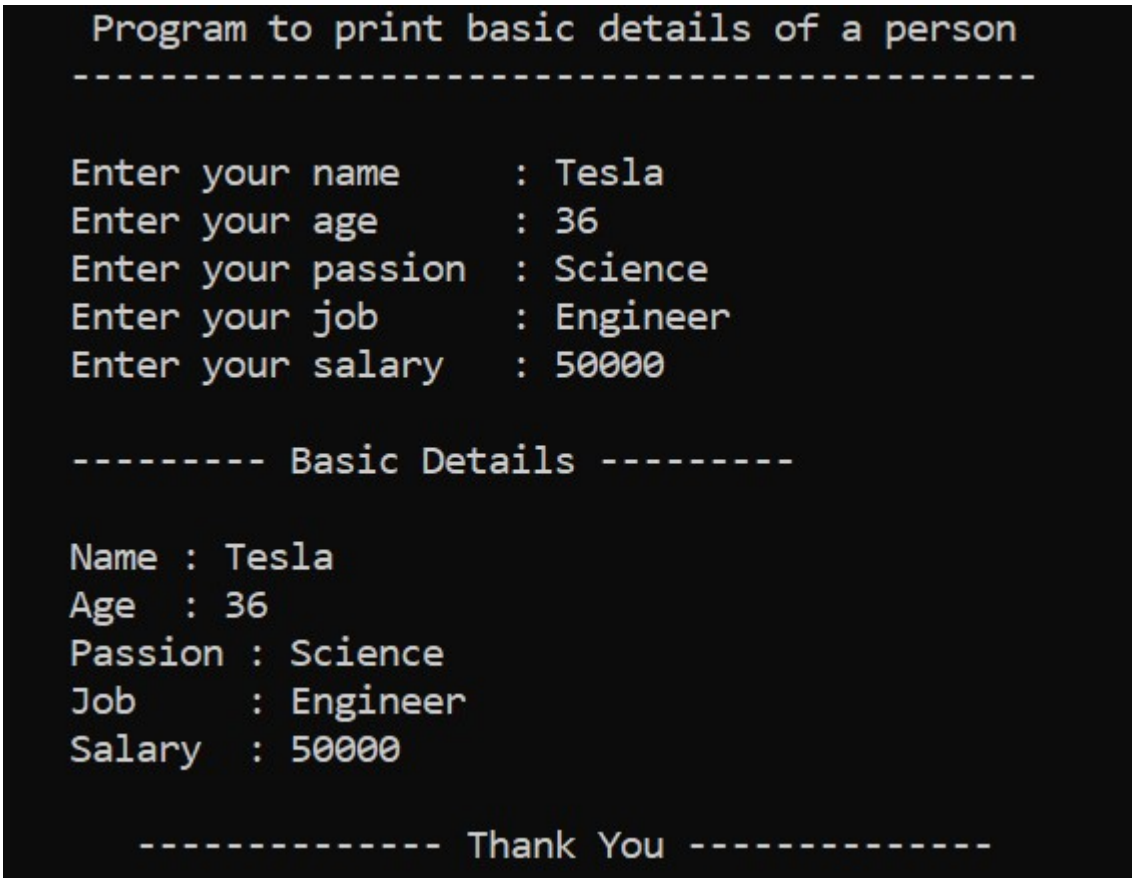
PROGRAM

```
#include <iostream>

using namespace std;

class passion
{
protected:

    string pass;

public:

    virtual void get_pass(string)=0;
    virtual void show_pass(void)=0;
};

class job
{
protected:

    float salary;
    string j_name;

public:

   virtual void get_salary(string,float)=0;
   virtual void show_salary(void)=0;
};

class person: public job, public passion
{
    string name;
    int age;
```

```
public:

    void get(string s,int x)
    {
        name=s;
        age=x;
    }

    void show(void)
    {
       cout<<"   Name : "<<name<<endl;
       cout<<"   Age  : "<<age<<endl;
    }

    void get_pass(string s)
    {
        pass=s;
    }

    void show_pass(void)
    {
        cout<<"   Passion : "<<pass<<endl;
    }

    void get_salary(string y,float x)
    {
        salary=x;
        j_name=y;
    }

   void show_salary(void)
    {
       cout<<"   Job     : "<<j_name<<endl;
       cout<<"   Salary  : "<<salary<<endl;
    }


};
int main()
{
```

```
    person p;
    string a,b,c,d;
    int x;
    float y;

    cout<<"    Program to print basic details of a person "<<endl;
    cout<<"   ------------------------------------------"<<endl;
    cout<<" "<<endl;
    cout<<"   Enter your name     : ";
    cin>>a;
    cout<<"   Enter your age      : ";
    cin>>x;
    cout<<"   Enter your passion  : ";
    cin>>c;
    cout<<"   Enter your job      : ";
    cin>>b;
    cout<<"   Enter your salary   : ";
    cin>>y;
    cout<<" "<<endl;

    p.get_salary(b,y);
    p.get_pass(c);
    p.get(a,x);


    cout<<"   --------- Basic Details ---------"<<endl;
    cout<<" "<<endl;
    p.show();
    p.show_pass();
    p.show_salary();
    cout<<" "<<endl;
    cout<<"      -------------- Thank You --------------"<<endl;

    return 0;
}
```

SAMPLE INPUT-OUTPUT



TEMPLATE CLASS

AIM

Write a C++ program to demonstrate the use of class templates.

PROGRAM

```
#include <iostream>

using namespace std;

template< class T>

class calculator
{
    T num1;
    T num2;

public:

    calculator(T x,T y)
    {
        num1=x;
        num2=y;
    }

    T add(void)
    {return(num1+num2);}

    T sub(void)
    {return(num1-num2);}

    T mul(void)
    {return(num1*num2);}

    T div(void)
    {return(num1/num2);}
};

string per()
{
```

```
    string check;
    cout<<" "<<endl;
    cout<<"   Do you want to continue ?"<<endl;
    cout<<"           yes or no?       "<<endl;
    cout<<":--";
    cin>>check;
    if(check!="yes"&&check!="no")
    {
        cout<<" "<<endl;
        cout<<"------------ Invalid Entry -------------"<<endl;
        cout<<" "<<endl;
        cout<<"   Do you want to continue ?"<<endl;
        cout<<"           yes or no?       "<<endl;
        cout<<":--";
        cin>>check;
    }
    cout<<" "<<endl;
    return check;
}

int main()
{
    int x,y;
    float w,z;
    int option;

    cout<<"    Program to find sum, difference, product and quotient of
    two numbers "<<endl;
    cout<<"   ------------------------------------------------------------
    ------------"<<endl;
    while(option!=3)
    {
        cout<<" "<<endl;
        cout<<"   Choose any of the following to continue "<<endl;
        cout<<"-------------------------------------------"<<endl;
        cout<<"   1 to calculate for integers choose "<<endl;
        cout<<"   2 to calculate for decimals choose "<<endl;
        cout<<"   3 to end the program               "<<endl;
        cout<<":--";
        cin>>option;
```

```
if(option==1)
{
    cout<<"   ------- Calculator for integers -------"<<endl;
    cout<<"  "<<endl;
    cout<<"    Enter the value of first number  :";
    cin>>x;
    cout<<"    Enter the value of second number :";
    cin>>y;

    calculator<int> calc1(x,y);
    cout<<"  "<<endl;
    cout<<"    "<<x<<" + "<<y<<" = "<<calc1.add()<<endl;
    cout<<"    "<<x<<" - "<<y<<" = "<<calc1.sub()<<endl;
    cout<<"    "<<x<<" * "<<y<<" = "<<calc1.mul()<<endl;
    cout<<"    "<<x<<" / "<<y<<" = "<<calc1.div()<<endl;
    if(per()=="no")
     {break;}
}

else if(option==2)
{
   cout<<"   ------- Calculator for decimals -------"<<endl;
    cout<<"  "<<endl;
    cout<<"    Enter the value of first number  :";
    cin>>w;
    cout<<"    Enter the value of second number :";
    cin>>z;

    calculator<float>calc2(w,z);
    cout<<"  "<<endl;
    cout<<"    "<<w<<" + "<<z<<" = "<<calc2.add()<<endl;
    cout<<"    "<<w<<" - "<<z<<" = "<<calc2.sub()<<endl;
    cout<<"    "<<w<<" * "<<z<<" = "<<calc2.mul()<<endl;
    cout<<"    "<<w<<" / "<<z<<" = "<<calc2.div()<<endl;
    if(per()=="no")
           {break;}
}
else if(option==3)
{
    break;
}
```

```
        else
        {
            cout<<"-------- Invalid Entry --------"<<endl;
            if(per()=="no")
                   {break;}
        }
}
cout<<"   ----------------- Thank You -----------------"<<endl;


return 0;
}
```

SAMPLE INPUT-OUTPUT

```
    Program to find sum, difference, product and quotient of two numbers
   ---------------------------------------------------------------------

   Choose any of the following to continue
-------------------------------------------
   1 to calculate for integers choose
   2 to calculate for decimals choose
   3 to end the program
:--1
   ------- Calculator for integers -------

    Enter the value of first number  :6
    Enter the value of second number :9

    6 + 9 = 15
    6 - 9 = -3
    6 * 9 = 54
    6 / 9 = 0

   Do you want to continue ?
          yes or no?
:--yes


   Choose any of the following to continue
-------------------------------------------
   1 to calculate for integers choose
   2 to calculate for decimals choose
   3 to end the program
:--2
   ------- Calculator for decimals -------

    Enter the value of first number  :3.6
    Enter the value of second number :1.6

    3.6 + 1.6 = 5.2
    3.6 - 1.6 = 2
    3.6 * 1.6 = 5.76
    3.6 / 1.6 = 2.25

   Do you want to continue ?
          yes or no?
:--no

   ---------------- Thank You ----------------
```

EXCEPTION HANDLING

AIM

Write a C++ program to demonstrate the use of exception handling.

PROGRAM

```
#include <iostream>

using namespace std;

int main()
{
    cout<<"    Program to demonstrate exception handling "<<endl;
    cout<<"   ----------------------------------------"<<endl;
    int option=6;

        while(option==6)
        {
            float a,b,c,d,x,y;
            cout<<" "<<endl;
            cout<<"   Enter values of a : ";
            cin>>a;
            cout<<"   Enter values of b : ";
            cin>>b;
            cout<<" "<<endl;

            cout<<"   Enter values of c : ";
            cin>>c;
            cout<<"   Enter values of d : ";
            cin>>d;
            cout<<" "<<endl;

            x = a-b;
            cout<<"   x = a-b "<<endl;
            cout<<"   x = "<<x<<endl;
            cout<<" "<<endl;

            y = c-d;
            cout<<"   y = c-d "<<endl;
            cout<<"   y = "<<y<<endl;
```

```
            try
            {
                if(y!=0)
                {
                    cout<<" "<<endl;
                    cout<<"   x/y = "<<x/y<<endl;
                    cout<<" "<<endl;
                }
                else
                    throw(y);
            }
            catch(float c)
            {
                cout<<" "<<endl;
                cout<<"             Exception identified : y = "<< y <<endl;
                cout<<"   --------- Division by zero is not defined --------"<<endl;
                cout<<" "<<endl;
            }
            cout<<"            Do you want to continue ?"<<endl;
            cout<<"   Press 6 to continue or any other number to exit"<<endl;
            cout<<":--";
            cin>>option;
            cout<<" "<<endl;



        }

        cout<<"   --------------- Thank You ---------------"<<endl;
        return 0;

}
```

SAMPLE INPUT-OUTPUT

```
    Program to demonstrate exception handling
   ------------------------------------------

   Enter values of a : 12
   Enter values of b : 6

   Enter values of c : 3
   Enter values of d : 3

   x = a-b
   x = 6

   y = c-d
   y = 0

             Exception identified : y = 0
   --------- Division by zero is not defined --------

            Do you want to continue ?
   Press 6 to continue or any other number to exit
:--6


   Enter values of a : 24
   Enter values of b : 36

   Enter values of c : 30
   Enter values of d : 3

   x = a-b
   x = -12

   y = c-d
   y = 27

   x/y = -0.444444

            Do you want to continue ?
   Press 6 to continue or any other number to exit
:--9

   --------------- Thank You ---------------
```