1. Operators Overloading

Problem Statement: Distance Calculation Using Operator Overloading You are required to implement a program that calculates distances using operator overloading in C++. The program should be able to perform the following operations on distances: Addition of Distances: Implement an addition operator (+) that adds two distances together. The distance should be represented in feet and inches. Subtraction of Distances: Implement a subtraction operator (-) that subtracts one distance from another. Ensure that the subtraction operation handles cases where the result may involve negative values or borrowing (like in subtraction of inches). Comparison of Distances: Implement comparison operators (==, !=, <, >, <=, >=) to compare distances based on their total length (combined feet and inches). Use these operators to determine which distance is greater, less than, or equal to another. Requirements: Distance Class: Implement a Distance class with appropriate member variables (feet and inches). Constructors: Implement constructors to initialize distances. Member Functions: Implement member functions for display and any other necessary operations. Operator Overloading: Overload the necessary operators (+, -, ==, !=, <, >, <=, >=) inside the Distance class to perform the specified operations. Testing: Create a main () function to test the implemented Distance class and its operator overloading functionality. Test various scenarios including addition, subtraction, and comparison of distances.

A: #include <iostream>

using namespace std;

class Distance {

private:

int feet;

float inches;

public:

Distance() : feet(0), inches(0.0) {}

Distance(int ft, float in) : feet(ft), inches(in) {}

void displayDistance() {

cout << "Feet: " << feet << " Inches: " << inches << endl;

}

Distance operator+(const Distance& d2) {

int totalFeet = feet + d2.feet;

float totalInches = inches + d2.inches;

if (totalInches >= 12.0) {

totalInches -= 12.0;

totalFeet++;

}

return Distance(totalFeet, totalInches);

}

Distance operator-(const Distance& d2) {

int totalFeet = feet - d2.feet;

float totalInches = inches - d2.inches;

if (totalInches < 0) {

totalInches += 12.0;

totalFeet--;

}

return Distance(totalFeet, totalInches);

}

bool operator==(Distance& d2) {

return (feet == d2.feet && inches == d2.inches); }

bool operator!=(Distance& d2) {

return !(\*this == d2); }

bool operator<(Distance& d2) {

float thisTotal = feet + (inches / 12.0);

float d2Total = d2.feet + (d2.inches / 12.0);

return thisTotal < d2Total; }

bool operator>(Distance& d2) {

return !(\*this < d2 || \*this == d2); }

bool operator<=(Distance& d2) {

return (\*this < d2 || \*this == d2); }

bool operator>=(Distance& d2) {

return !(\*this < d2); }

};

int main() {

Distance d1(10, 6.5);

Distance d2(5, 3.25);

Distance sum = d1 + d2;

cout << "Sum of distances: ";

sum.displayDistance();

Distance diff = d1 - d2;

cout << "Difference of distances: ";

diff.displayDistance();

if (d1 == d2)

cout << "Distances are equal" << endl;

else if (d1 != d2)

cout << "Distances are not equal" << endl;

if (d1 < d2)

cout << "Distance d1 is less than d2" << endl;

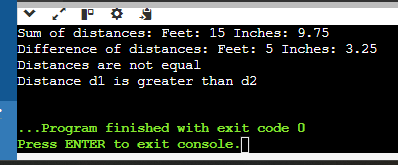
else if (d1 > d2)

cout << "Distance d1 is greater than d2" << endl;

return 0;

}

OUTPUT:



**Write a code in cpp swapping two value use Reference**

#include <iostream>

using namespace std;

void passbyVal(int a, int b) {

int temp = a;

a = b;

b = temp;

}

void passbyRe(int &a, int &b) {

int temp = a;

a = b;

b = temp;

}

int main() {

int a = 20, b = 30;

cout << "Original values: a = " << a << ", b = " << b << endl;

passbyVal(a, b);

cout << "After passbyVal: a = " << a << ", b = " << b << endl;

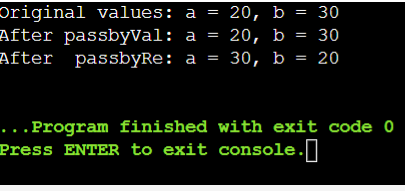
passbyRe(a, b);

cout << "After passbyRe: a = " << a << ", b = " << b << endl;

return 0;

}

**Output:**



**Ambiguity:**

#include<iostream>

using namespace std;

void test(int a){

cout<<"x is"<<a<<endl;

}

void test(int a,int b=6)

{

cout<<"x is"<<a<<endl<<"y is"<<endl;

}

int main(){

int x=5,y=6;

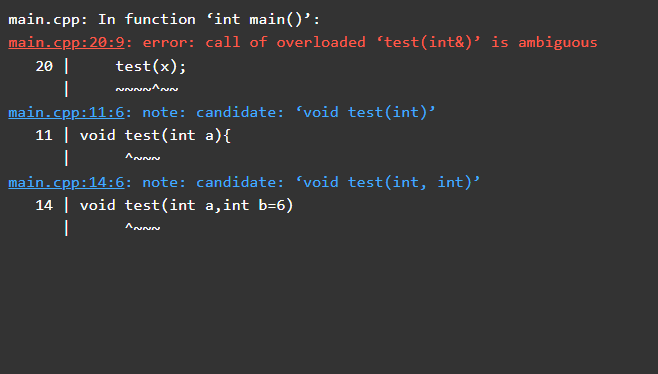
test(x);

test(x,y);

return 0;

}

**Output:**



2.Overload the following operators for the Matrix class:

+ (addition): Allows addition of two matrices.

\* (multiplication): Allows multiplication of two matrices.

Ensure that the operations adhere to matrix addition and multiplication rules (e.g., matrix dimensions compatibility). Input and Output: Implement a function to input matrices from the user or use predefined matrices for testing purposes. Display the result of matrix addition and multiplication operations using overloaded operators. Testing and Output: Create a main() function to test your Matrix class and its operator overloading functionality. Test with multiple matrices of different dimensions to demonstrate compile-time polymorphism through operator overloading.

#include <iostream>

using namespace std;

class Matrix {

private:

int m[10][10];

int rows;

int cols;

public:

Matrix(int r, int c) : rows(r), cols(c) {

for (int i = 0; i < rows; ++i) {

for (int j = 0; j < cols; ++j) {

m[i][j] = 0;

}

}

}

void inputMatrix() {

cout << "Enter matrix elements row-wise:" << endl;

for (int i = 0; i < rows; ++i) {

for (int j = 0; j < cols; ++j) {

cin >> m[i][j];

}

}

}

void displayMatrix() {

cout << "Matrix:" << endl;

for (int i = 0; i < rows; ++i) {

for (int j = 0; j < cols; ++j) {

cout << m[i][j] << " ";

}

cout << endl;

}

}

Matrix operator+(Matrix& matrix) {

Matrix result(rows, cols);

for (int i = 0; i < rows; ++i) {

for (int j = 0; j < cols; ++j) {

result.m[i][j] = m[i][j] + matrix.m[i][j];

}

}

return result;

}

Matrix operator\*(Matrix& matrix) {

Matrix result(rows, matrix.cols);

for (int i = 0; i < rows; ++i) {

for (int j = 0; j < matrix.cols; ++j) {

result.m[i][j] = 0;

for (int k = 0; k < cols; ++k) {

result.m[i][j] += m[i][k] \* matrix.m[k][j];

}

}

}

return result;

}

};

int main() {

Matrix A(3, 3);

Matrix B(3, 3);

cout << "Enter elements for matrix A:" <<endl;

A.inputMatrix();

cout << "Enter elements for matrix B:" <<endl;

B.inputMatrix();

cout << "Matrix A:" <<endl;

A.displayMatrix();

cout << "Matrix B:" <<endl;

B.displayMatrix();

Matrix C = A + B;

cout << "Result of A + B:" <<endl;

C.displayMatrix();

Matrix D = A \* B;

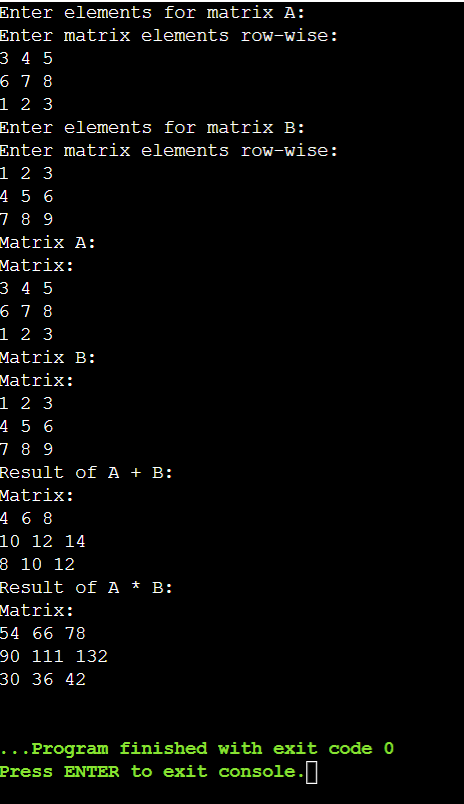
cout << "Result of A \* B:" <<endl;

D.displayMatrix();

return 0;

}

Output:



3. Operator overloading:

Problem Statement: Distance Calculation Using Operator Overloading

You are required to implement a program that calculates distances using operator overloading in C++. The program should be able to perform the following operations on distances:

Addition of Distances: Implement an addition operator (+) that adds two distances together. The distance should be represented in feet and inches. Subtraction of Distances: Implement a subtraction operator (-) that subtracts one distance from another. Ensure that the subtraction operation handles cases where the result may involve negative values or borrowing (like in subtraction of inches). Comparison of Distances: Implement comparison operators (==, !=, <, >, <=, >=) to compare distances based on their total length (combined feet and inches). Use these operators to determine which distance is greater, less than, or equal to another. Requirements: Distance Class: Implement a Distance class with appropriate member variables (feet and inches). Constructors: Implement constructors to initialize distances. Member Functions: Implement member functions for display and any other necessary operations. Operator Overloading: Overload the necessary operators (+, -, ==, !=, <, >, <=, >=) inside the Distance class to perform the specified operations. Testing: Create a main() function to test the implemented Distance class and its operator overloading functionality. Test various scenarios including addition, subtraction, and comparison of distances**.**

#include <iostream>

using namespace std;

class Distance {

private:

int feet;

float inches;

public:

Distance() : feet(0), inches(0.0) {}

Distance(int ft, float in) : feet(ft), inches(in) {}

void displayDistance() {

cout << "Feet: " << feet << " Inches: " << inches << endl;

}

Distance operator+(const Distance& d2) {

int totalFeet = feet + d2.feet;

float totalInches = inches + d2.inches;

if (totalInches >= 12.0) {

totalInches -= 12.0;

totalFeet++;

}

return Distance(totalFeet, totalInches);

}

Distance operator-(const Distance& d2) {

int totalFeet = feet - d2.feet;

float totalInches = inches - d2.inches;

if (totalInches < 0) {

totalInches += 12.0;

totalFeet--;

}

return Distance(totalFeet, totalInches);

}

bool operator== (Distance& d2) {

return (feet == d2.feet && inches == d2.inches); }

bool operator!=(Distance& d2) {

return !(\*this == d2); }

bool operator<(Distance& d2) {

float thisTotal = feet + (inches / 12.0);

float d2Total = d2.feet + (d2.inches / 12.0);

return thisTotal < d2Total; }

bool operator>(Distance& d2) {

return !(\*this < d2 || \*this == d2); }

bool operator<=(Distance& d2) {

return (\*this < d2 || \*this == d2); }

bool operator>=(Distance& d2) {

return !(\*this < d2); }

};

int main() {

Distance d1(10, 6.5);

Distance d2(5, 3.25);

Distance sum = d1 + d2;

cout << "Sum of distances: ";

sum.displayDistance();

Distance diff = d1 - d2;

cout << "Difference of distances: ";

diff.displayDistance();

if (d1 == d2)

cout << "Distances are equal" << endl;

else if (d1 != d2)

cout << "Distances are not equal" << endl;

if (d1 < d2)

cout << "Distance d1 is less than d2" << endl;

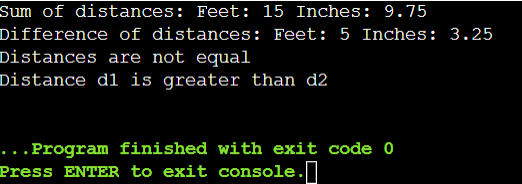
else if (d1 > d2)

cout << "Distance d1 is greater than d2" << endl;

return 0;

}

OUTPUT:



4. Problem Statement: Shape Area Calculator Using Method Overloading

You are required to implement a program that calculates the area of different shapes using compile-time polymorphism (method overloading) in C++. The program should support calculation of areas for the following shapes:

Rectangle

Circle

Triangle

Requirements:

Shape Class: Implement a Shape class as a base class with virtual functions to calculate and display the area of each shape.

Derived Classes: Implement derived classes Rectangle, Circle, and Triangle, inheriting from Shape, each with overridden functions to calculate and display their respective areas.

Method Overloading: Use method overloading in the Shape class to define multiple calculateArea functions, each specific to one shape.

Input and Output: Implement a main() function to test the implemented classes by creating instances of each shape, inputting dimensions, and displaying their calculated areas.

#include <iostream>

#include <cmath>

using namespace std;

class Shape {

public:

virtual void calculateArea() {

cout << "Calculating area of generic shape" << endl;

}

virtual void displayArea() {

cout << "Area: " << area << endl;

}

protected:

double area;

};

class Rectangle : public Shape {

public:

Rectangle(double l, double b) : length(l), breadth(b) {}

void calculateArea() override {

area = length \* breadth;

}

private:

double length;

double breadth;

};

class Circle : public Shape {

public:

Circle(double r) : radius(r) {}

void calculateArea() override {

area = M\_PI \* radius \* radius;

}

private:

double radius;

};

class Triangle : public Shape {

public:

Triangle(double b, double h) : base(b), height(h) {}

void calculateArea() override {

area = 0.5 \* base \* height;

}

private:

double base;

double height;

};

int main() {

Rectangle rect(5.0, 3.0);

Circle circle(4.5);

Triangle triangle(4.0, 2.5);

rect.calculateArea();

circle.calculateArea();

triangle.calculateArea();

cout << "Rectangle Area: ";

rect.displayArea();

cout << "Circle Area: ";

circle.displayArea();

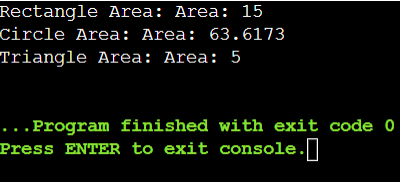
cout << "Tria Triangle Area: ";

triangle.displayArea();

return 0;

}

OUTPUT:



Question 1: Shape Hierarchy

Create a base class Shape with a pure virtual function draw() that has no implementation. Derive classes Square, Circle, and Triangle from Shape. Each derived class should override draw() to provide its specific drawing behavior (e.g., printing "\*" for square, "OOO" for circle, etc.). Write a function printShape(Shape shape) that takes a base class pointer and calls draw() on it. Demonstrate polymorphism by creating objects of the derived classes, storing them in a Shape\* array, and calling printShape() on each element.

#include <iostream>

using namespace std;

class Shape {

public:

virtual void draw() = 0;

virtual ~Shape() {}

};

class Square : public Shape {

public:

void draw() override {

cout << "Drawing a Square: \*\*\*\*\*" << endl;

}

};

class Circle : public Shape {

public:

void draw() override {

cout << "Drawing a Circle: OOOO" << endl;

}

};

class Triangle : public Shape {

public:

void draw() override {

cout << "Drawing a Triangle: #####" << endl;

}

};

void printShape(Shape\* shape) {

shape->draw();

}

int main() {

Square square;

Circle circle;

Triangle triangle;

Shape\* shapes[3];

shapes[0] = &square;

shapes[1] = &circle;

shapes[2] = &triangle;

for (int i = 0; i < 3; ++i) {

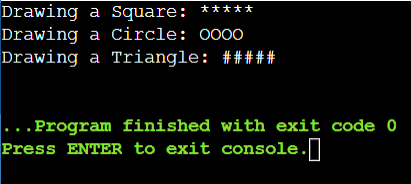
printShape(shapes[i]);

}

return 0;

}

OUTPUT:



Question 2: Animal Sounds

Design a base class Animal with a pure virtual function makeSound() that returns a string representing the animal's sound. Derive classes like Dog, Cat, and Bird from Animal, each overriding makeSound() with the appropriate sound ("Woof!", "Meow!", "Chirp!"). Create a function playAnimalSound(Animal\* animal) that takes an Animal pointer and calls makeSound(). Populate an Animal\* array with various animal objects and use playAnimalSound() to hear their sounds polymorphically.

#include <iostream>

#include <string>

using namespace std;

class Animal {

public:

virtual string makeSound() = 0;

};

class Dog : public Animal {

public:

string makeSound() override {

return "Woof!";

}

};

class Cat : public Animal {

public:

string makeSound() override {

return "Meow!";

}

};

class Bird : public Animal {

public:

string makeSound() override {

return "Chirp!";

}

};

void playAnimalSound(Animal\* animal) {

cout << animal->makeSound() << endl;

}

int main() {

Dog dog;

Cat cat;

Bird bird;

Animal\* animals[] = { &dog, &cat, &bird };

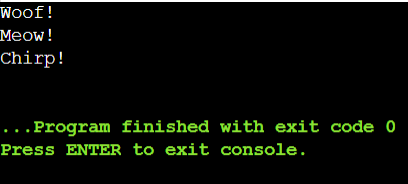
for (int i = 0; i < 3; ++i) {

playAnimalSound(animals[i]);

}

return 0;

}

OUTPUT:  


**Copy Constructor:**

#include<iostream>

using namespace std;

class Point{

public:

double x,y;

Point(){

x=0.0; y=0.0;

cout<<"default constructor"<<endl;

}

Point(double nx, double ny){

x = nx; y = ny;

cout<<"2-parameter constructor"<<endl;

}

};

int main(){

Point q(1.0,2.0);

Point r = q;

}

**Output:**

