DOMAIN WINTER CAMP

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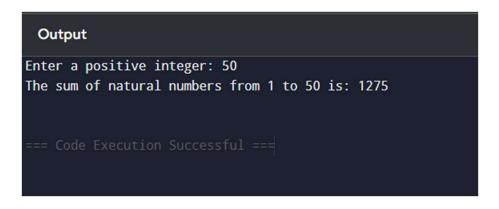
DAY-1

Q.1. Calculate the sum of all natural numbers from 1 to n, where n is a positive integer.

Program Code:-

```cpp
#include <iostream>

using namespace std;

int main() {

    int n, sum = 0;

    cout << "Enter a positive integer: ";

    cin >> n;

    for (int i = 1; i <= n; i++) {

        sum += i;

    }

    cout << "The sum of natural numbers from 1 to " << n << " is: " << sum << endl;

    return 0;
```

}

Output:-

```
Output

Enter a positive integer: 50
The sum of natural numbers from 1 to 50 is: 1275


=== Code Execution Successful ===
```

Q.2. Count the total number of digits in a given number n. The number can be a positive integer. For example, for the number 12345, the count of digits is 5. For a number like 900000, the count of digits is 6.

Program Code:-

```cpp
#include <iostream>

using namespace std;

int main() {

    int n, count = 0;

    cout << "Enter a positive integer: ";

    cin >> n;

    while (n != 0) {

        n /= 10;

        count++;

    }

    cout << "The total number of digits is: " << count << endl;

    return 0;}
```

Output:-

```
Output

Enter a positive integer: 65432
The total number of digits is: 5


=== Code Execution Successful ===
```

Q.3. Write a program to calculate the area of different shapes using function overloading. Implement overloaded functions to compute the area of a circle, a rectangle, and a triangle.

Program Code:-

```cpp
#include <iostream>

using namespace std;


double calculateArea(double radius) {

    return 3.14159 * radius * radius;

}

double calculateArea(double length, double breadth) {

    return length * breadth;

}

double calculateArea(double a, double b, double c) {

    double s = (a + b + c) / 2.0;

    double area = s * (s - a) * (s - b) * (s - c);

    double result = 1;

    for (int i = 0; i < 10; ++i) {

        result = 0.5 * (result + area / result);

    }

    return result;

}

int main() {
```

```cpp
    double radius, length, breadth, a, b, c;

    cout << "Enter radius of circle: ";

    cin >> radius;

    cout << "Area of Circle: " << calculateArea(radius) << endl;

    cout << "Enter length and breadth of rectangle: ";

    cin >> length >> breadth;

    cout << "Area of Rectangle: " << calculateArea(length, breadth) << endl;

    cout << "Enter sides of triangle: ";

    cin >> a >> b >> c;

    cout << "Area of Triangle: " << calculateArea(a, b, c) << endl;

    return 0;

}
```

Output:-

```
Output

Enter radius of circle: 12
Area of Circle: 452.389
Enter length and breadth of rectangle: 8 4
Area of Rectangle: 32
Enter sides of triangle: 2 4 9
Area of Triangle: -38.8626
```

Q.4. Write a program to demonstrate runtime polymorphism in C++ using a base class Shape and derived classes Circle, Rectangle, and Triangle. The program should use virtual functions to calculate and print the area of each shape based on user input.

Program Code:-

```cpp
#include <iostream>

using namespace std;

class Shape {

public:

    virtual void calculateArea() = 0;

    virtual ~Shape() {}

};

class Circle : public Shape {

    double radius;

public:

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

    void calculateArea() override {

        cout << "Area of Circle: " << 3.14159 * radius * radius << endl;

    }

};

class Rectangle : public Shape {

    double length, breadth;

public:
```

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

    void calculateArea() override {

        cout << "Area of Rectangle: " << length * breadth << endl;

    }

};

class Triangle : public Shape {

    double base, height;

public:

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

    void calculateArea() override {

        cout << "Area of Triangle: " << 0.5 * base * height << endl;

    }

};

int main() {

    Shape* shape;

    int choice;

    cout << "Choose a shape to calculate area:\n";

    cout << "1. Circle\n2. Rectangle\n3. Triangle\n";

    cin >> choice;
```

```cpp
switch (choice) {

case 1: {

    double radius;

    cout << "Enter radius of circle: ";

    cin >> radius;

    shape = new Circle(radius);

    break;

}

case 2: {

    double length, breadth;

    cout << "Enter length and breadth of rectangle: ";

    cin >> length >> breadth;

    shape = new Rectangle(length, breadth);

    break;

}

case 3: {

    double base, height;

    cout << "Enter base and height of triangle: ";

    cin >> base >> height;
```

```cpp
        shape = new Triangle(base, height);

        break;

    }

    default:

        cout << "Invalid choice!" << endl;

        return 1;

    }

    shape->calculateArea();

    delete shape;

    return 0;

}
```

Output:-

```
Output

Choose a shape to calculate area:
1. Circle
2. Rectangle
3. Triangle
1
Enter radius of circle: 12
Area of Circle: 452.389
```

Q.5. Design a C++ program using function overloading to perform arithmetic operations on complex numbers. Define a Complex class with real and imaginary parts. Overload functions to handle the following operations:

Addition: Sum of two complex numbers.

Multiplication: Product of two complex numbers.

Magnitude: Calculate the magnitude of a single complex number.

The program should allow the user to select an operation, input complex numbers, and display results in the format a + bi or a - bi (where b is the imaginary part).

Program Code:-

```cpp
#include <iostream>

#include <cmath>

using namespace std;

class Complex {

public:

    double real, imag;

    Complex(double r = 0, double i = 0) {

        real = r;

        imag = i;

    }

    Complex operator+(const Complex& c) const {

        return Complex(real + c.real, imag + c.imag);

    }
```

```cpp
    Complex operator*(const Complex& c) const {

        return Complex(real * c.real - imag * c.imag,

                real * c.imag + imag * c.real);

    }

    double magnitude() const {

        return sqrt(real * real + imag * imag);

    }

};

void display(const Complex& c) {

    cout << c.real << " + " << c.imag << "i";

}

int main() {

    int choice;

    Complex c1, c2, result;

    cout << "Select an operation:\n";

    cout << "1. Addition\n";

    cout << "2. Multiplication\n";

    cout << "3. Magnitude\n";

    cin >> choice;
```

```cpp
switch (choice) {

    case 1:

        cout << "Enter the real and imaginary parts of the first complex number: ";

        cin >> c1.real >> c1.imag;

        cout << "Enter the real and imaginary parts of the second complex number: ";

        cin >> c2.real >> c2.imag;

        result = c1 + c2;

        cout << "Sum: ";

        display(result);

        break;

    case 2:

        cout << "Enter the real and imaginary parts of the first complex number: ";

        cin >> c1.real >> c1.imag;

        cout << "Enter the real and imaginary parts of the second complex number: ";

        cin >> c2.real >> c2.imag;

        result = c1 * c2;

        cout << "Product: ";

        display(result);
```

```cpp
            break;

        case 3:

            cout << "Enter the real and imaginary parts of the complex number: ";

            cin >> c1.real >> c1.imag;

            cout << "Magnitude: " << c1.magnitude() << endl;

            break;

        default:

            cout << "Invalid choice.\n";

    }

    return 0;

}
```

Output:-

```
Output
Select an operation:
1. Addition
2. Multiplication
3. Magnitude
2
Enter the real and imaginary parts of the first complex number: 2 3
Enter the real and imaginary parts of the second complex number: 1 -1
Product: 5 + 1i
```