DOMAIN WINTER CAMP

(Department of Computer Science and Engineering)

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DAY 1

Ques 1. Calculate the sum of all natural numbers from 1 to n, where n is a positive integer. Use the formula:
Sum=n×(n+1)/2.
Take n as input and output the sum of natural numbers from 1 to n.

Program code:

```
#include <bits/stdc++.h>
using namespace std;

#define ll long long

int main(){
 int a;
 cin>>a;
 cout<<"Sum of n natural number: ";
cout<< a*(a+1)/2<<endl;



return 0;
}
```

Output:

```
ankitvashisth@Ankits-MacBook-Pro ~ % g++ oneday.cpp -o o
neday && ./oneday
15
Sum of n natural number: 120
```

Ques 2. Print all odd numbers between 1 and n, inclusive. Odd numbers are integers that are not divisible by 2. These numbers should be printed in ascending order, separated by spaces.

This problem is a simple introduction to loops and conditional checks. The goal is to use a loop to iterate over the numbers and check if they are odd using the condition i%2≠0.

Program code:

```
#include <bits/stdc++.h>
using namespace std;

#define ll long long

int main(){

   int n;
   cout << "Enter a positive integer n: ";
   cin >> n;

   if (n > 0) {
      cout << "Odd numbers between 1 and " << n << " are: ";
      for (int i = 1; i <= n; i += 2) {
         cout << i << " ";
      }
      cout << endl;
   } else {
      cout << "Please enter a positive integer." << endl;
   }
```

```
    return 0;


}
```

Output:

```
ankitvashisth@Ankits-MacBook-Pro ~ % g++ oneday.cpp -o o
neday && ./oneday
Enter a positive integer n: 10
Odd numbers between 1 and 10 are: 1 3 5 7 9
```

Ques 3. 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.

Given an integer n, your task is to determine how many digits are present in n. This task will help you practice working with loops, number manipulation, and conditional logic.

Program Code:

```
#include <bits/stdc++.h>
using namespace std;

#define ll long long

int main(){


    int n;
    cout << "Enter a positive integer n: ";
    cin >> n;

    if (n > 0) {
        int digitCount = 0;
        while (n > 0) {
            n /= 10; // Remove the last digit
            digitCount++;
        }
        cout << "The total number of digits is: " << digitCount << endl;
```

```
    } else {
        cout << "Please enter a positive integer." << endl;
    }

    return 0;
}
```

Output:

```
ankitvashisth@Ankits-MacBook-Pro ~ % g++ oneday.cpp -o o
neday && ./oneday
Enter a positive integer n: 10023
The total number of digits is: 5
```

Ques 4. 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:

```
#include <bits/stdc++.h>
using namespace std;

#define ll long long
double area(double radius) {
    return M_PI * radius * radius;
}

double area(double length, double width) {
    return length * width;
}

double area(double base, double height, bool isTriangle) {
    return 0.5 * base * height;
}
```

```
int main() {
    double radius, length, width, base, height;

    cout << "Enter the radius of the circle: ";
    cin >> radius;

    cout << "Enter the length and width of the rectangle: ";
    cin >> length >> width;

    cout << "Enter the base and height of the triangle: ";
    cin >> base >> height;

    cout << "\nAreas of the shapes:\n";
    cout << "Circle: " << area(radius) << endl;
    cout << "Rectangle: " << area(length, width) << endl;
    cout << "Triangle: " << area(base, height, true) << endl;

    return 0;
```

Output:

```
ankitvashisth@Ankits-MacBook-Pro ~ % g++ oneday.cpp -o o
neday && ./oneday
Enter the radius of the circle: 12
Enter the length and width of the rectangle: 3 4
Enter the base and height of the triangle: 1 34

Areas of the shapes:
Circle: 452.389
Rectangle: 12
Triangle: 17
```

Ques 5. 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:

```
#include <bits/stdc++.h>
using namespace std;

#define ll long long



class Shape {
public:
    virtual void area() = 0; // Pure virtual function
    virtual ~Shape() {}
};

class Circle : public Shape {
    double radius;
public:
    Circle(double r) : radius(r) {}
```

```
    void area() override {
        cout << "Area of Circle: " << M_PI * radius * radius << endl;
    }
};

class Rectangle : public Shape {
    double length, width;
public:
    Rectangle(double l, double w) : length(l), width(w) {}
    void area() override {
        cout << "Area of Rectangle: " << length * width << endl;
    }
};

class Triangle : public Shape {
    double base, height;
public:
    Triangle(double b, double h) : base(b), height(h) {}
    void area() override {
        cout << "Area of Triangle: " << 0.5 * base * height << endl;
    }
};

int main() {
    double radius, length, width, base, height;

    cout << "Enter the radius of the circle: ";
    cin >> radius;
    Circle circle(radius);
```

```
    cout << "Enter the length and width of the rectangle: ";
    cin >> length >> width;
    Rectangle rectangle(length, width);

    cout << "Enter the base and height of the triangle: ";
    cin >> base >> height;
    Triangle triangle(base, height);

    Shape* shapes[] = { &circle, &rectangle, &triangle };

    cout << "\nCalculating areas of shapes:\n";
    for (Shape* shape : shapes) {
        shape->area();
    }

    return 0;
}
```

Output:

```
ankitvashisth@Ankits-MacBook-Pro ~ % g++ oneday.cpp -o o
neday && ./oneday
Enter the radius of the circle: 10
Enter the length and width of the rectangle: 20 10
Enter the base and height of the triangle: 23 11

Calculating areas of shapes:
Area of Circle: 314.159
Area of Rectangle: 200
Area of Triangle: 126.5
```