Lab Task 1

Introduction to Data Structures and Algorithms

Name: Misbah Ullah Jan

ID: CU-4273-2023

Subject: Data Structures and Algorithms

Teacher: Madam Hijab Durrani

Language Used: Python

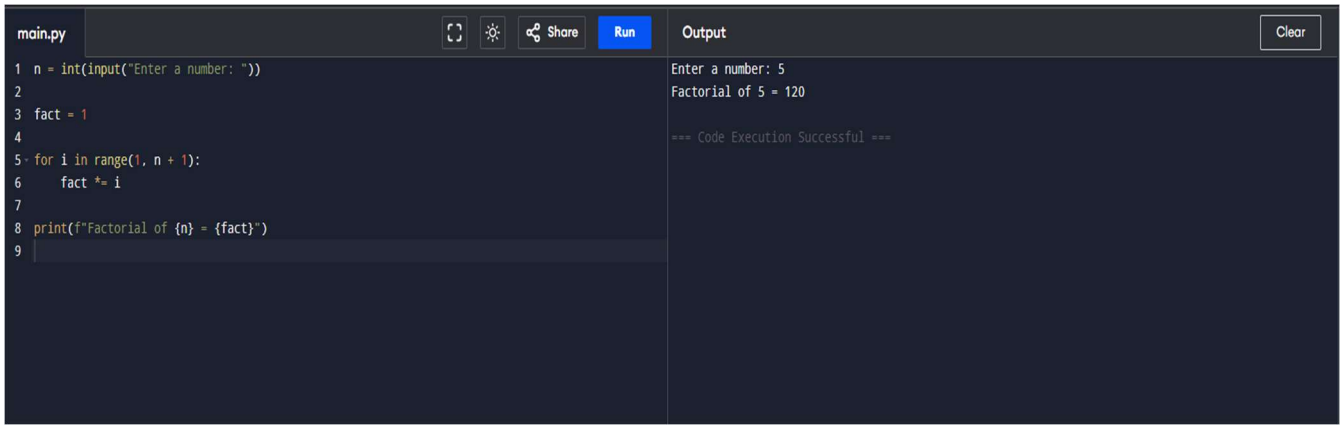
Q1:Write a program to calculate the factorial of a number using iteration.

Algorithm (Factorial of a Number)

1. Start.
2. Input n.
3. Initialize fact = 1.
4. Repeat for i = 1 to n:
   → fact = fact * i.
5. Print fact.
6. Stop.

CODE IN PYTHON:

```
n = int(input("Enter a number: "))
fact = 1
for i in range(1, n + 1):
   fact *= i
print(f"Factorial of {n} = {fact}")
```



OUTPUT:

Enter a number: 5

Factorial of 5 = 120

Result:

The program successfully computes the factorial of a given number using iteration.

Time Complexity: O(n)

Space Complexity: O(1)

Q2: Write a program to calculate the sum of even numbers up to n.

Algorithm (Sum of Even Numbers up to n)

1. Start.
2. Input n.
3. Initialize sum = 0.

4. Repeat for i = 2 to n with step 2:
   → sum = sum + i.
5. Print sum.
6. Stop.

CODE IN PYTHON:

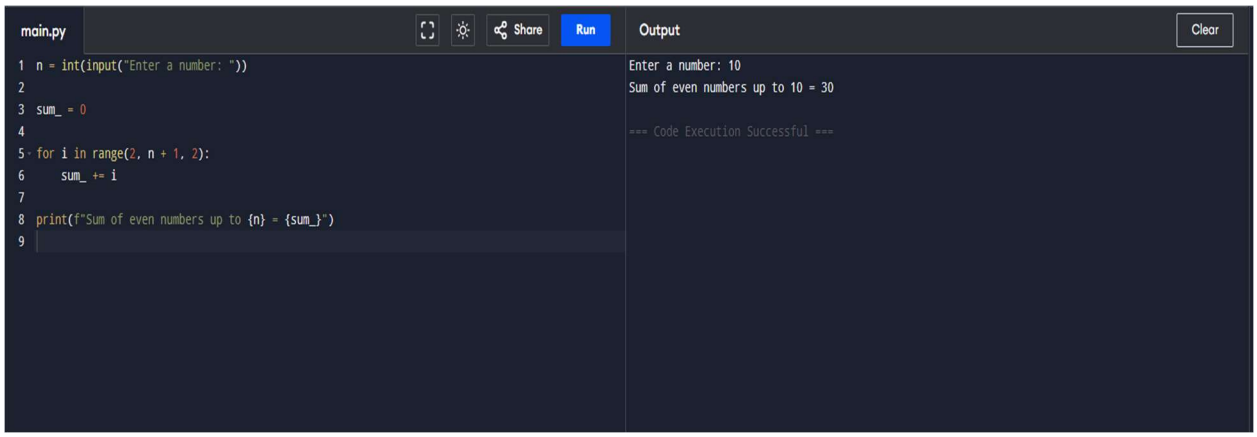
```
n = int(input("Enter a number: "))

sum_ = 0

for i in range(2, n + 1, 2):

   sum_ += i

print(f"Sum of even numbers up to {n} = {sum_}")
```



OUTPUT:

Enter a number: 10

Sum of even numbers up to 10 = 30

Result:

The program successfully computes the sum of all even numbers up to the given number n.

Time Complexity: O(n)

Space Complexity: O(1)

Q3. Write a program to calculate the Fibonacci series up to n terms.

Algorithm (Fibonacci Series up to n terms)

1. Start.
2. Input number of terms n.
3. Initialize a = 0, b = 1.
4. Repeat n times:
   → Print a.
   → c = a + b.
   → a = b.
   → b = c.
5. Stop.

CODE IN PYTHON:

```
n = int(input("Enter number of terms: "))


a, b = 0, 1


for i in range(n):
    print(a, end=" ")
    a, b = b, a + b
```

OUTPUT:

Enter number of terms: 6

0 1 1 2 3 5

Result:

- The program successfully displays the Fibonacci series up to the given number of terms.

Time Complexity: O(n)

Space Complexity: O(1)

Q4. Debug Task: Find and fix the error in the given code (it should compute sum of n numbers).

GIVEN CODE WITH ERROR:

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

int main() {
   int n, sum = 0;
   cout << "Enter a number: ";
   cin >> n;
   for (int i = 0; i < n; i--) {
      sum = sum + i;
   }
   cout << "Sum = " << sum;
   return 0;
}
```

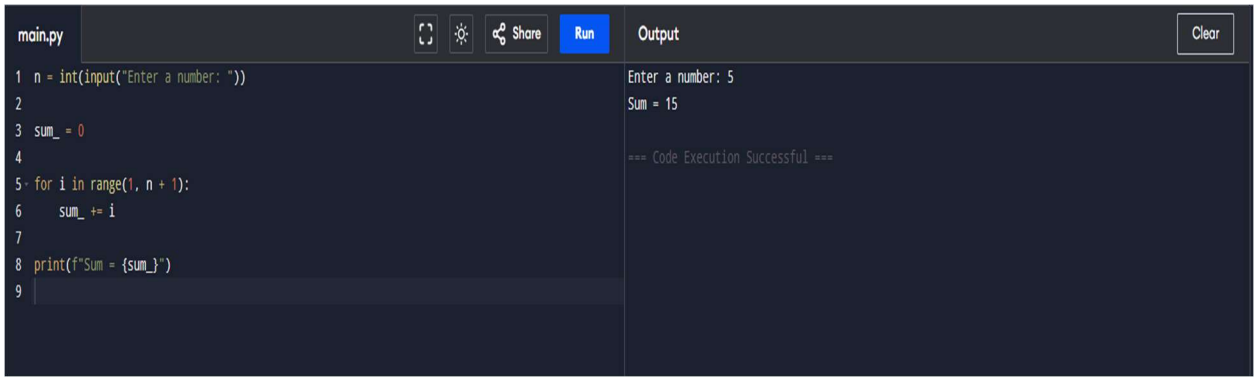
Corrected Code (Python Implementation):

```
n = int(input("Enter a number: "))


sum_ = 0


for i in range(1, n + 1):
    sum_ += i


print(f"Sum = {sum_}")
```



OUTPUT:

Enter a number: 5

Sum = 15

Result: The program successfully computes the sum of the first n natural numbers after fixing the loop increment.

Time Complexity: O(n)

Space Complexity: O(1)
