

Lab Task 1

Introduction to Data Structures and Algorithms

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Subject: Data Structures and Algorithms

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Language Used: Python

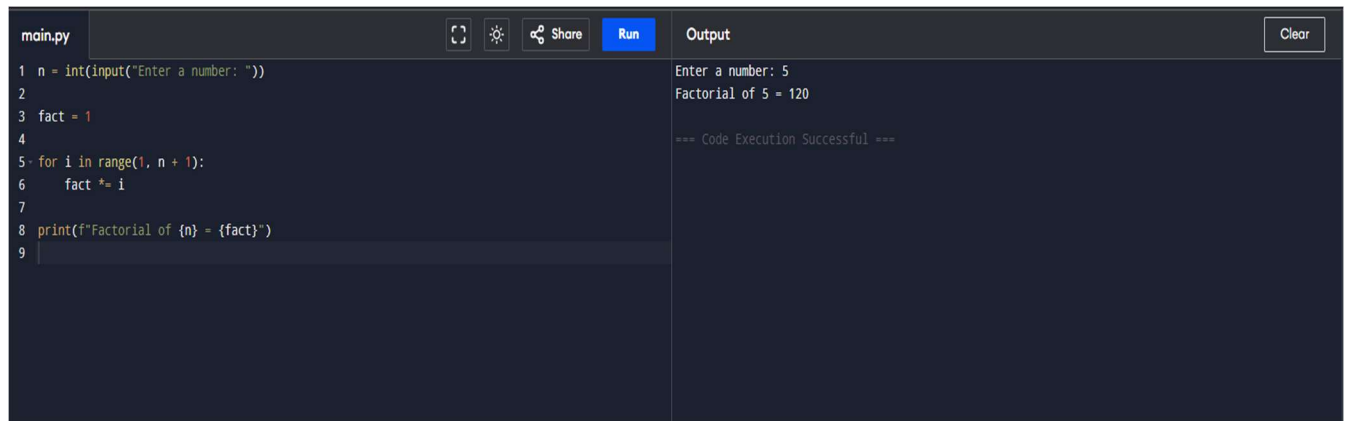
Q1:Write a program to calculate the factorial of a number using iteration.

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}")
```



The screenshot shows a code editor with a file named 'main.py'. The code is a Python program that calculates the factorial of a number entered by the user. The code is as follows:

```
1 n = int(input("Enter a number: "))
2
3 fact = 1
4
5 for i in range(1, n + 1):
6     fact *= i
7
8 print(f"Factorial of {n} = {fact}")
9
```

The output window on the right shows the following text:

```
Enter a number: 5
Factorial of 5 = 120

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

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:

→ $\text{sum} = \text{sum} + i$.

5. Print sum.

6. Stop.

CODE IN PYTHON:

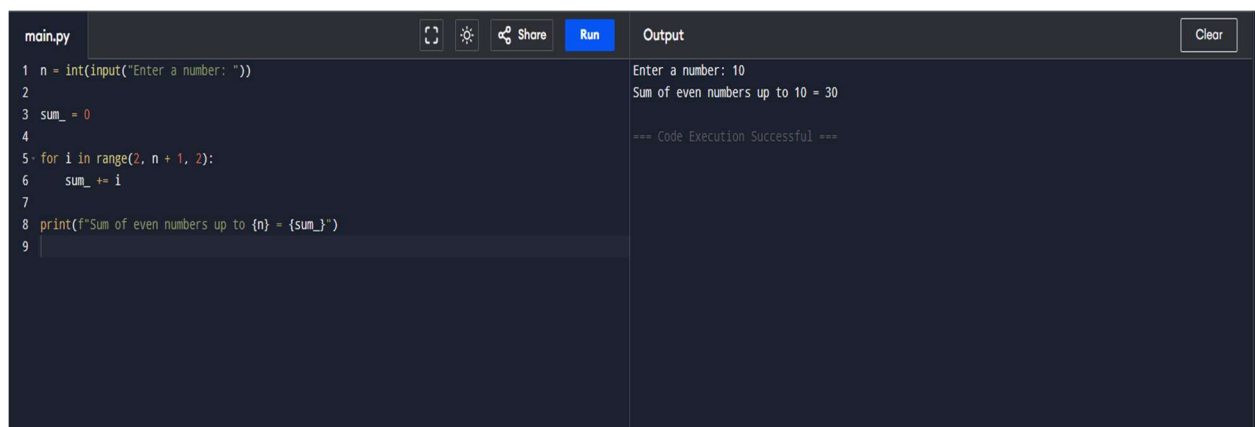
```
n = int(input("Enter a number: "))
```

```
sum_ = 0
```

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

```
    sum_ += i
```

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



```
main.py  [Icons]  Run  Output  Clear
```

```
1 n = int(input("Enter a number: "))
2
3 sum_ = 0
4
5 for i in range(2, n + 1, 2):
6     sum_ += i
7
8 print(f"Sum of even numbers up to {n} = {sum_}")
9
```

```
Enter a number: 10
Sum of even numbers up to 10 = 30

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

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:

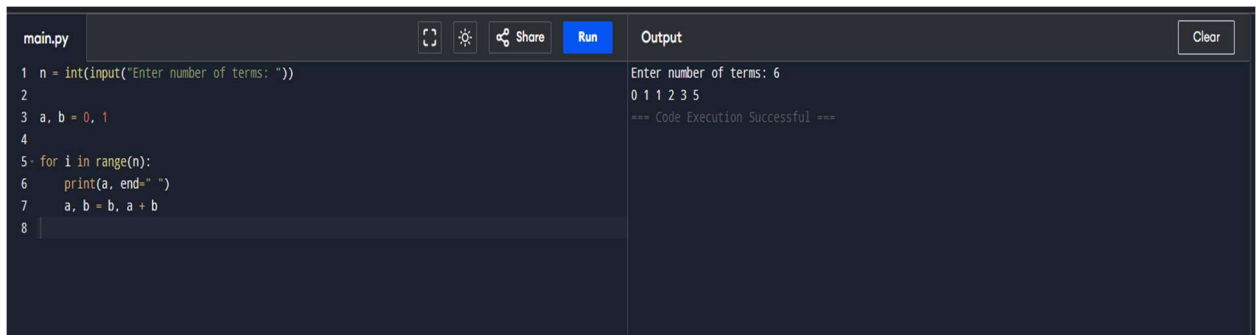
```
n = int(input("Enter number of terms: "))
```

```
a, b = 0, 1
```

```
for i in range(n):
```

```
    print(a, end=" ")
```

```
    a, b = b, a + b
```



The screenshot shows a Python IDE with a file named 'main.py'. The code in the editor is as follows:

```
1 n = int(input("Enter number of terms: "))
2
3 a, b = 0, 1
4
5 for i in range(n):
6     print(a, end=" ")
7     a, b = b, a + b
8
```

The IDE has a toolbar with icons for file operations, a 'Share' button, and a 'Run' button. The 'Output' panel on the right shows the following text:

```
Enter number of terms: 6
0 1 1 2 3 5
=== Code Execution Successful ===
```

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):

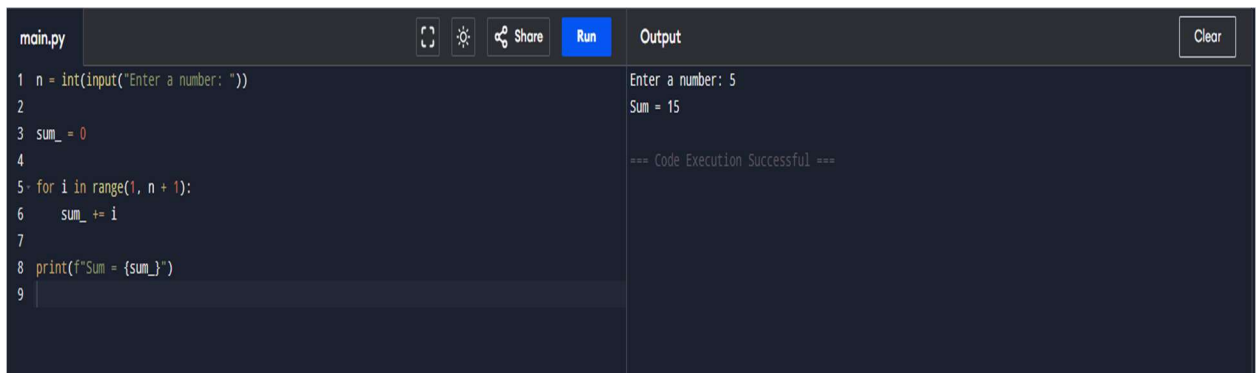
```
n = int(input("Enter a number: "))
```

```
sum_ = 0
```

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

```
    sum_ += i
```

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



The screenshot shows a code editor with a dark theme. The file name is 'main.py'. The code is as follows:

```
1 n = int(input("Enter a number: "))
2
3 sum_ = 0
4
5 for i in range(1, n + 1):
6     sum_ += i
7
8 print(f"Sum = {sum_}")
9
```

The editor has buttons for 'Run', 'Share', and 'Clear'. The output panel on the right shows the following:

```
Enter a number: 5
Sum = 15
=== Code Execution Successful ===
```

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: $O(1)$
