

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 :
 \rightarrow 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 interface with a dark theme. On the left, the file 'main.py' contains the following Python code:

```
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
```

At the top right are several icons: a file icon, a sun icon, a share icon, and a 'Run' button. To the right of the code area is a 'Output' panel. The output shows the execution results:

```
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_}")
```

The screenshot shows a Python code editor interface with a dark theme. On the left, the code file 'main.py' is open, containing the following Python code:

```
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
```

On the right, the 'Output' tab displays the results of running the code. It shows the user input 'Enter a number: 10', the program's response 'Sum of even numbers up to 10 = 30', and a success message '== 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 code editor window titled "main.py". The code 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
```

On the right side, under the "Output" tab, the user enters "Enter number of terms: 6". The program then prints the output "0 1 1 2 3 5" followed by the message "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 interface with a dark theme. On the left, the file 'main.py' is open, displaying the following Python code:

```
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
```

On the right, there is an 'Output' panel. It contains the user input 'Enter a number: 5', the program's response 'Sum = 15', and a success message '*** Code Execution Successful ***'. There are also several small icons at the top of the output panel.

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: $O(1)$
