Lab Sheet 2: Compare Running Time of Algorithms

Aim:

To compare the running time of two algorithms for calculating the sum of first n natural numbers using:

• Loop-based method

• Formula-based method

Procedure:

• Open Turbo C and create a new C program.

• Include the required header files such as stdio.h and time.h.

• Write a program to calculate the sum of first n natural numbers using a loop-based approach.

• Use the clock() function to record the start time before executing the loop.

• Record the end time after the loop execution and calculate the total execution time using CLOCKS_PER_SEC.

• Write another program to calculate the sum using the formula-based approach.

• Measure the execution time of the formula-based method in the same manner.

• Compile and run both programs separately.

• Observe and compare the execution time obtained for both approaches.

Program 1: Loop-Based Approach (O(n))

```
#include <stdio.h>
#include <time.h>
int main() {
int n = 1000000;
long sum = 0;
clock_t start, end;
start = clock();
for(int i = 1; i <= n; i++)
sum += i;
end = clock();
printf("Loop Method Time: %f seconds\n",
(double)(end-start)/CLOCKS_PER_SEC);
return 0;
}
```

Program 2: Formula-Based Approach (O(1))

```
#include <stdio.h>
#include <time.h>
int main() {
int n = 1000000;
long sum;
clock_t start, end;
start = clock();
sum = n * (n + 1) / 2;
end = clock();
printf("Formula Method Time: %f seconds\n",
(double)(end-start)/CLOCKS_PER_SEC);
return 0;
}
```

Result:

The formula-based approach executed faster than the loop-based approach, proving that algorithms with lower time

complexity perform better.