Algorithm Task

Project Idea: 1 (Climbing Stair)

Team Number: 12

1- Climbing Stair

You are climbing a stair case. It takes n steps to reach to the top. Each time you can either climb 1 or 2 steps. Design an algorithm that calculate how many distinct ways can you climb to the top? Note: Given n will be a positive integer.

GitHub Link: AhmedMetwaly12/algorithmtask (github.com)

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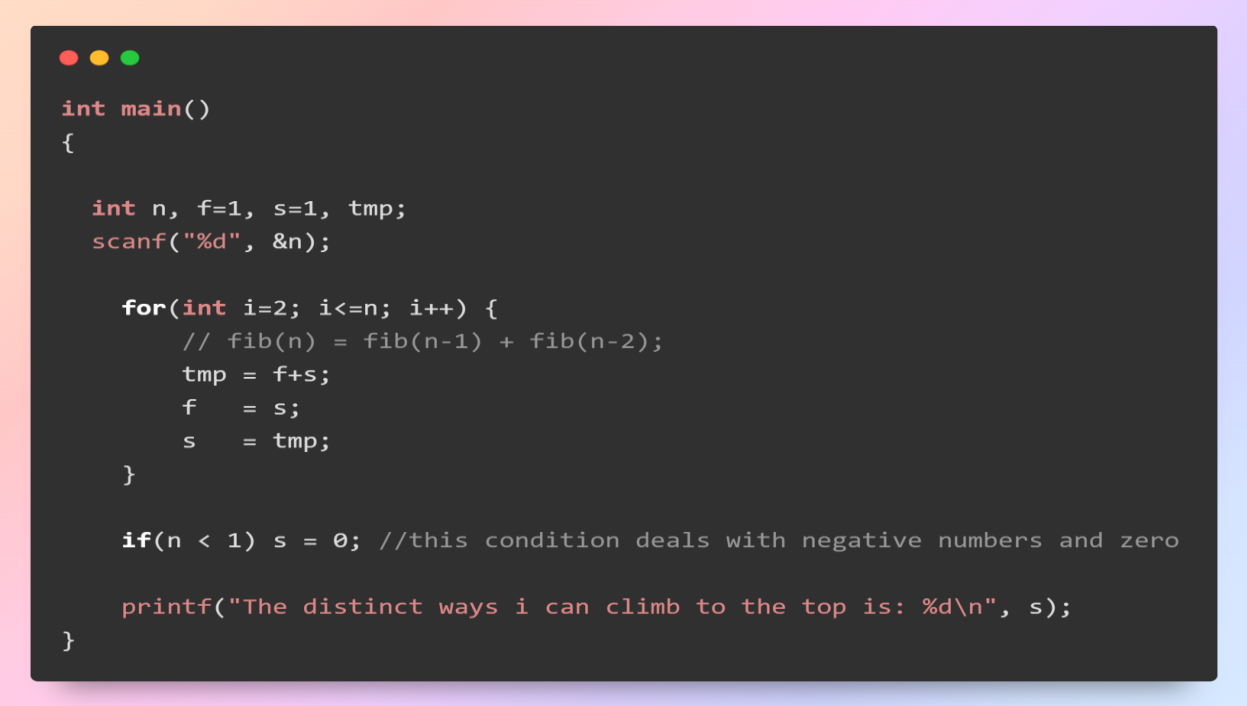
Code Number 1:



```c
int main()
{

  int n, f=1, s=1, tmp;
  scanf("%d", &n);

    for(int i=2; i<=n; i++) {
        // fib(n) = fib(n-1) + fib(n-2);
        tmp = f+s;
        f   = s;
        s   = tmp;
    }

    if(n < 1) s = 0; //this condition deals with negative numbers and zero

    printf("The distinct ways i can climb to the top is: %d\n", s);
}
```

Pseudocode of Code Number 1

```
f := 1
s := 1
Read integer n from the user
for I := 2 to n do {
        tmp := f+s
        f := s
        s := tmp
}
If n < 1 then
        s := 0
print s
```

Analysis of Code Number 1

$$C(n) = \sum_{i=1}^{n} 1 = n\text{-}2 = O(n)$$

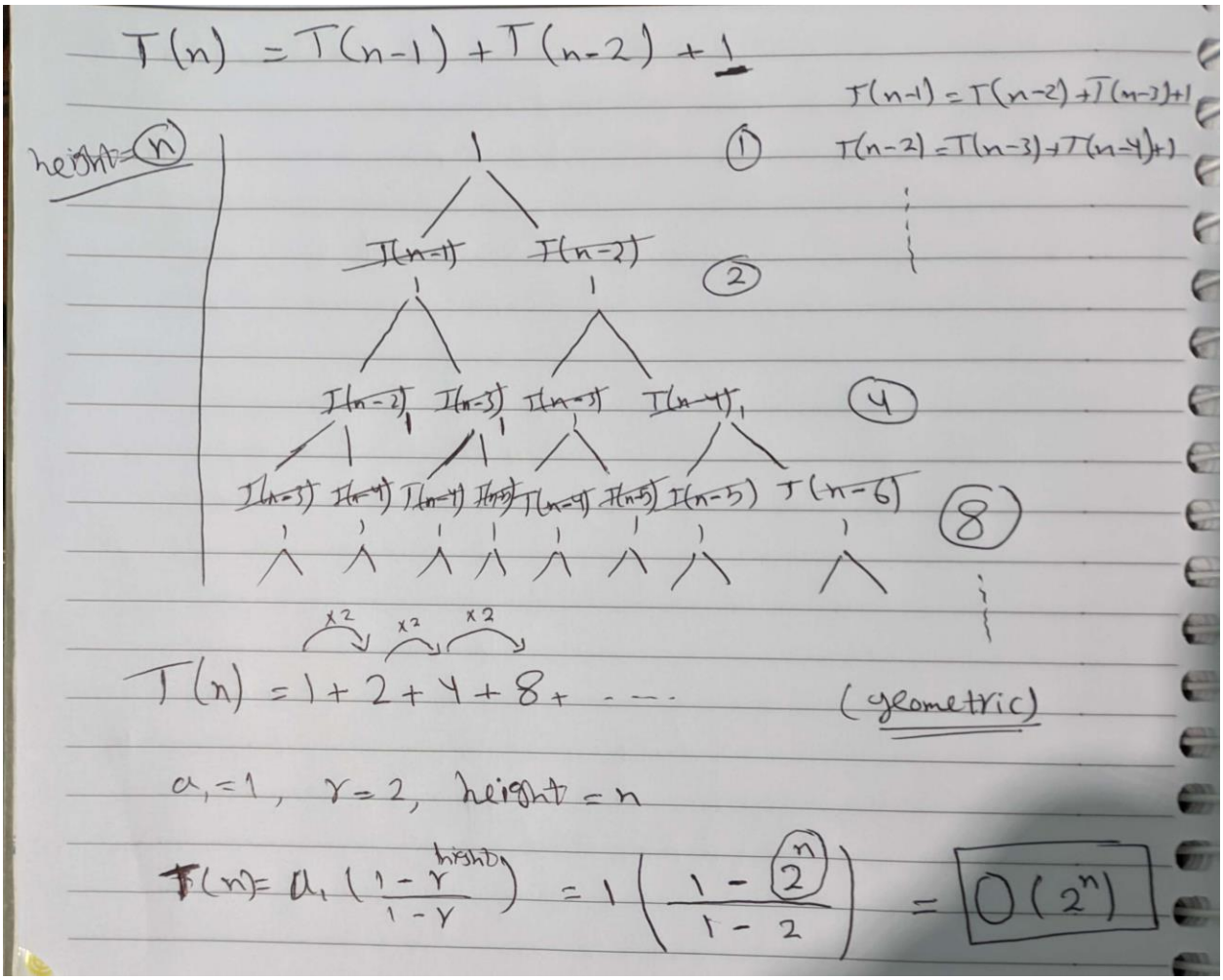
Code Number 2

```c
int fibonacci(int n) {
    if(n < 1) return 0; //this condition deals with negative numbers and zero

    if (n <= 2) return n; // 2=>2, 1=>1

    return fibonacci(n-1) + fibonacci(n-2);
}
```

Pseudocode of Code Number 2

```
function fibonacci(n)
   if n < 1 then
        return 0
   if n <= 2 then
      return n
   return fibonacci(n-1) + fibonacci(n-2)
```

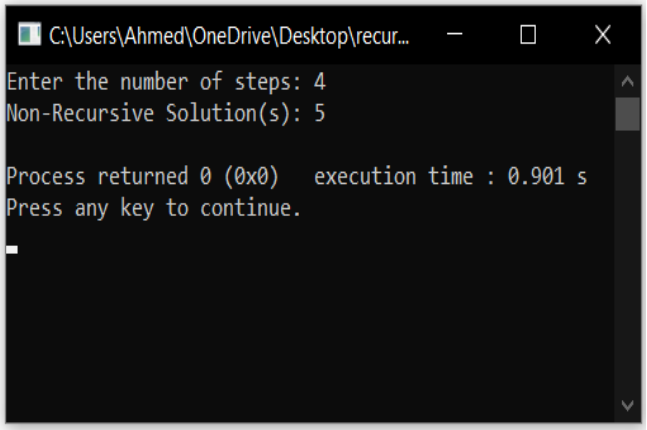
Analysis of Code Number 2



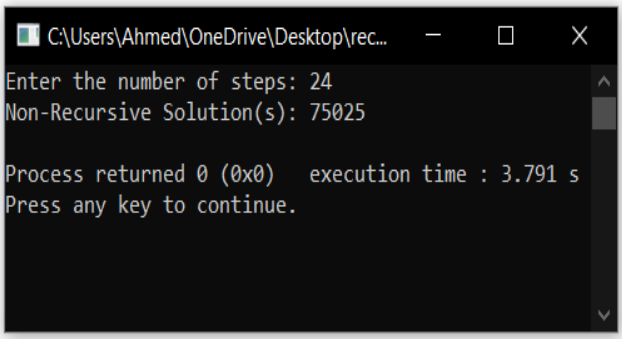
Test Run of Codes

Code 1

```c
#include <stdio.h>
#include <stdlib.h>

int main()
{

    int n, f=1, s=1, tmp;
    printf("Enter the number of steps: ");
    scanf("%d", &n);

    for(int i=2; i<=n; i++) {
        // fib(n) = fib(n-1) + fib(n-2);
        tmp = f+s;
        f   = s;
        s   = tmp;
    }
    if(n < 1) s = 0; //this condition deals with negative numbers and zero
    printf("Non-Recursive Solution(s): %d\n", s);
}
```

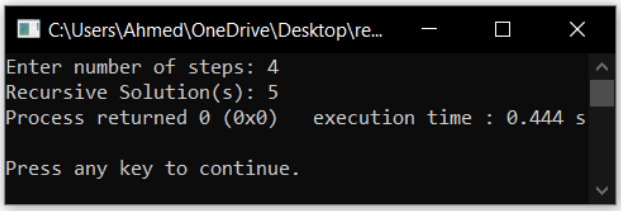



```c
#include <stdio.h>
#include <stdlib.h>

int main(){

    int n, f=1, s=1, tmp;
    printf("Enter the number of steps: ");
    scanf("%d", &n);

    for(int i=2; i<=n; i++) {
        // fib(n) = fib(n-1) + fib(n-2);
        tmp = f+s;
        f   = s;
        s   = tmp;
    }
    if(n < 1) s = 0; //this condition deals with negative numbers and zero
    printf("Non-Recursive Solution(s): %d\n", s);
}
```



Code 2

```c
#include <stdio.h>
#include <stdlib.h>

int fibonacci(int n) {
     if(n < 1) return 0;
     if (n <= 2) return n; // 2=>2, 1=>1
     return fibonacci(n-1) + fibonacci(n-2);
}

int main()
{

     int n;
     printf("Enter number of steps: ");
     scanf("%d", &n);
     printf("Recursive Solution(s): %d",fibonacci(n));
}
```




```c
#include <stdio.h>
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int fibonacci(int n) {
     if(n < 1) return 0;
     if (n <= 2) return n; // 2=>2, 1=>1
     return fibonacci(n-1) + fibonacci(n-2);
}

int main()
{

     int n;
     printf("Enter number of steps: ");
     scanf("%d", &n);
     printf("Recursive Solution(s): %d",fibonacci(n));
}
```

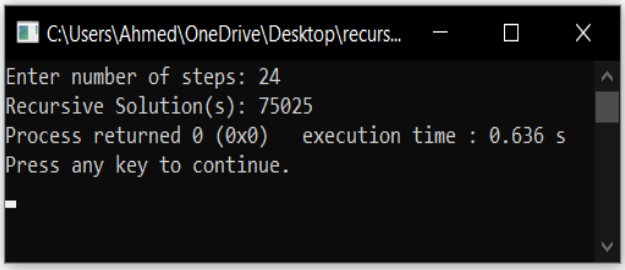

Comparison

Code No	Best Case	Worst Case
1	$\Omega(1)$	$O(n)$
2	$\Omega(1)$	$O(2^n)$

Therefore: Code number 1 is better, more time efficient.