Ex. No: 2   **Date: 20.08.24**

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Finding Time Complexity of Algorithms

2.a. Finding Complexity using Counter Method

Aim: Convert the following algorithm into a program and find its time complexity
using the counter method.

```
void function (int n)
{
    int i= 1;    int s =1;

    while(s <= n)
    {
        i++;
        s += i;
     }
}
```

Note: No need of counter increment for declarations and scanf() and count variable
printf() statements.

Input:
 A positive Integer n
Output:
Print the value of the counter variable

Algorithm:

void function(int n){

   set count = 0

   set i = 1

    increment count by 1

    set s = 1

    increment count by 1

    while (s <=n){

       increment count by 1

       increment i by 1

       increment count by 1

       set s = s + i

       increment count by 1

    }

    increment count by 1

    print count

}

Program:

```c
#include<stdio.h>

void function(int n){
    int count=0;
    int i=1;
    count++;
    int s=1;
    count++;
    while(s<=n){
        count++;
        i++;
        count++;
        s+=i;
        count++;
```


```
        }
        count++;
        printf("%d",count);
    }
    int main(){
        int n;
        scanf("%d",&n);
        function(n);
    }
```

Output:

	Input	Expected	Got	
✔	9	12	12	✔
✔	4	9	9	✔

Passed all tests! ✔

2.b. Finding Complexity using Counter Method

Aim: Convert the following algorithm into a program and find its time complexity using the counter method.

```
void func(int n)
{
    if(n==1)
    {
      printf("*");
    }
    else
    {
     for(int i=1; i<=n; i++)
     {
       for(int j=1; j<=n; j++)
       {
          printf("*");
          printf("*");
          break;
       }
     }
    }
}
```

Note: No need of counter increment for declarations and scanf() and count variable printf() statements.
Input:
 A positive Integer n
Output:
Print the value of the counter variable

Algorithm:

void func(int n){

   initialize count to 0

  if n = 1{

    increment count by 1

    print "*"

  }

  else{

    increment count by 1


```
    // outer loop from 1 to n
    for each i from 1 to n{
       increment count by 1


       // inner loop from 1 to n
       for each j from 1 to n {
          increment count by 1


          // simulate print statements with count increments
          increment count by 1  // first simulated printf("*")
          increment count by 1  // second simulated printf("*")


          // exit inner loop immediately
          increment count by 1  // break statement
       }
       increment count by 1

    }
    increment count by 1

  }
   print count
}
```

Program:

```
#include<stdio.h>
void func(int n)
{   int count=0;
    if(n==1)
    { count++;
      printf("*");
```



```c
        }
    else
    {count++;
     for(int i=1; i<=n; i++)
     { count++;
       for(int j=1; j<=n; j++)
       {  count++;
          //printf("*");
          count++;
          //printf("*");
          count++;
          break;
       }
       count++;
     }
     count++;
    }
    printf("%d",count);
}


int main(){
    int n;
    scanf("%d",&n);
    func(n);
}
```

Output:

	Input	Expected	Got	
✔	2	12	12	✔
✔	1000	5002	5002	✔
✔	143	717	717	✔

	Input	Expected	Got	
✔	2	12	12	✔
✔	1000	5002	5002	✔

2.c. Finding Complexity using Counter Method

Aim: Convert the following algorithm into a program and find its time complexity
using counter method.

```
Factor(num) {
{
   for (i = 1; i <= num;++i)
   {
    if (num % i== 0)
      {
        printf("%d ", i);
      }
    }
  }
}
```

Note: No need of counter increment for declarations and scanf() and counter variable
printf() statement.

Input:
 A positive Integer n
Output:
Print the value of the counter variable

Algorithm:

function Factor(num) {

   initialize count to 0

   // loop from 1 to num

   for each i from 1 to num {

      increment count by 1

      // check if i is a factor of num

      if num modulo i equals 0 {

         increment count by 1

         // simulate printing i (e.g., printf("%d ", i);)

      }

        increment count by 1 // end of inner if-statement

    }

    increment count by 1 // after loop completion

    print count

}

Program:

```c
#include<stdio.h>
void Factor(int num)
{   int count=0;
    for (int i = 1; i <= num;++i)
    {
        count++;
        if (num % i== 0)
        {
            count++;
            //printf("%d ", i);
        }
        count++;
    }
    count++;
    printf("%d",count);
}


int main(){
    int n;
    scanf("%d",&n);
    Factor(n);
```


}

Output:

	Input	Expected	Got	
✔	12	31	31	✔
✔	25	54	54	✔
✔	4	12	12	✔

2.d. Finding Complexity using Counter Method

Aim: Convert the following algorithm into a program and find its timecomplexity using counter method.

```
void function(int n)
{
    int c= 0;
    for(int i=n/2; i<n; i++)
        for(int j=1; j<n; j = 2 * j)
            for(int k=1; k<n; k = k * 2)
                c++;
}
```

Note: No need of counter increment for declarations and scanf() and count variable printf() statements.

Input:
 A positive Integer n
Output:
Print the value of the counter variable

Algorithm:

function(n) {

   initialize count to 0

   initialize c to 0

   increment count by 1

   // outer loop: i goes from n/2 to n-1

   for each i from n/2 to n-1 {

     increment count by 1

     // middle loop: j starts at 1 and doubles each iteration until j < n

     for each j starting from 1 and doubling each time (j = 2 * j) until j < n {

        increment count by 1


```
        // inner loop: k starts at 1 and doubles each iteration until k < n
        for each k starting from 1 and doubling each time (k = k * 2) until k < n {
            increment count by 1
            increment c by 1
            increment count by 1
        }

        increment count by 1  // after inner loop ends
    }

    increment count by 1  // after middle loop ends
  }

  increment count by 1  // after outer loop ends

  print count
}
```

Program:

```
#include<stdio.h>
void function(int n)
{
    int count=0;
    int c= 0;
    count++;
    for(int i=n/2; i<n; i++){
        count++;
        for(int j=1; j<n; j = 2 * j){
            count++;
            for(int k=1; k<n; k = k * 2){
```


```c
            count++;
            c++;
            count++;
        }
        count++;
    }
    count++;
}
count++;
printf("%d",count);
}
int main(){
    int n;
    scanf("%d",&n);
    function(n);
}
```

Output:

	Input	Expected	Got	
✔	4	30	30	✔
✔	10	212	212	✔

2.e. Finding Complexity using Counter Method

Aim: Convert the following algorithm into a program and find its time complexity
using counter method.

```
void reverse(int n)
{
   int rev = 0, remainder;
   while (n != 0)
    {
        remainder = n % 10;
        rev = rev * 10 + remainder;
        n/= 10;


    }
print(rev);
}
```

Note: No need of counter increment for declarations and scanf() and count variable
printf() statements.

Input:
 A positive Integer n
Output:
Print the value of the counter variable

Algorithm:

function reverse(n) {

   initialize count to 0

   initialize rev to 0

   initialize remainder

   increment count by 1 // for initialization

   // loop until n is not equal to 0

   while n is not equal to 0 {

      increment count by 1 // start of loop

      remainder = n modulo 10

      increment count by 1 // after calculating remainder


```
        rev = rev * 10 + remainder

        increment count by 1  // after updating rev


        n = n divided by 10

        increment count by 1  // after updating n

    }


    increment count by 1  // after loop ends


    // simulate printing rev (e.g., print(rev))

    increment count by 1  // for print statement


    print count

}
```

Program:

```c
#include<stdio.h>
void reverse(int n)
{
   int count=0;
    int rev = 0, remainder;
   count++;
   while (n != 0)
    {
       count++;
       remainder = n % 10;
       count++;
       rev = rev * 10 + remainder;
       count++;
```



```c
        n/= 10;

        count++;


    }
    count++;
//print(rev);
count++;
printf("%d",count);
}


int main(){
    int n;
    scanf("%d",&n);
    reverse(n);
}
```

Output:

	Input	Expected	Got	
✔	12	11	11	✔
✔	1234	19	19	✔