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**DEPT : CSE - A**

# TIME COMPLEXITY

## QUESTION 2.1

### 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

#### For example:

Input	Result
9	12

### AIM:

Step 1: Start

Step 2: Input the integer n

Step 3: Initialize c to 0 to count operations

Step 4: Initialize i to 1

Step 5: Increment c by 1

Step 6: Initialize s to 1

Step 7: Increment c by 1

Step 8: While  $s$  is less than or equal to  $n$ , do Steps 8.1 to 8.5

Step 8.1: Increment  $c$  by 1

Step 8.2: Increment  $i$  by 1

Step 8.3: Increment  $c$  by 1 Step 8.4:

Add  $i$  to  $s$  ( $s += i$ )

Step 8.5: Increment  $c$  by 1

Step 9: Increment  $c$  by 1

Step 10: Print the value of  $c$

Step 11: Stop

**PROGRAM:**

```

#include<stdio.h>
void function(int n)
{
    int c=0;
    int i=1;
    c++;
    int s=1;
    c++;
    while(s<=n)
    {
        c++;
        i++;
        c++;
        s+=i;
        c++;
    }
    c++;
    printf("%d",c);
}
int main()
{
    int n;
    scanf("%d",&n);
    function(n);
    return 0;
}

```

**OUTPUT :**

	Input	Expected	Got	
✓	9	12	12	✓
✓	4	9	9	✓

Passed all tests! ✓

**RESULT:**

The above code is executed successfully and gives expected output.

## QUESTION 2.2

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:

Step 1: Start

Step 2: Input the integer n

Step 3: Initialize c to 0 to count operations

Step 4: If n is equal to 1, go to Step 5, else go to Step 7

Step 5: Increment c by 1

Step 6: Print "\*" and go to Step 12

Step 7: Increment c by 1

Step 8: For each integer i from 1 to n, do Steps 9 to 11

Step 9: Increment c by 1

Step 10: For each integer  $j$  from 1 to  $n$ , do Steps 10.1 to 10.4

Step 10.1: Increment  $c$  by 1

Step 10.2: Increment  $c$  by 1

Step 10.3: Increment  $c$  by 1

Step 10.4: Break out of the inner loop

Step 11: Increment  $c$  by 1

Step 12: Increment  $c$  by 1

Step 13: Print the value of  $c$

Step 14: Stop

## **PROGRAM:**

```

#include<stdio.h>
void func(int n)
{
    int c=0;
    if(n==1)
    {
        c++;
        printf("*");
    }
    else
    {
        c++;
        for(int i=1; i<=n; i++)
        {
            c++;
            for(int j=1; j<=n; j++)
            {
                c++;
                //printf("*");
                c++;
                //printf("*");
                c++;
                break;
            }
            c++;
        }
        c++;
    }
    printf("%d",c);
}

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

```

**OUTPUT:**

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

## RESULT:

The above code is executed successfully and gives expected output.

## QUESTION 2.3

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:

Step 1: Start

Step 2: Input the integer n

Step 3: Initialize c to 0 to count operations

Step 4: For each integer i from 1 to n, do Steps 5 to 7

Step 5: Increment c by 1

Step 6: If n is divisible by i ( $n \% i == 0$ ), increment c by 1

Step 7: Increment c by 1

Step 8: Increment **c** by **1**  
Step 9: Print the value of **c**  
Step 10: Stop

**PROGRAM:**



```
#include <stdio.h>

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

int main() {
    int n;
    scanf("%d", &n);
    Factor(n);
    return 0;
}
```

#### OUTPUT:

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

Passed all tests! ✓

#### RESULT:

The above code is executed successfully and gives expected output.

## QUESTION 2.4

Convert the following algorithm into a program and find its time complexity 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:

Step 1: Start

Step 2: Input the integer n

Step 3: Initialize count to 0 to count operations

Step 4: Initialize c to 0

Step 5: Increment count by 1

Step 6: For each integer i from n/2 to n - 1, do Steps 7 to 9

Step 7: Increment count by 1

Step 8: Initialize j to 1 and while j is less than n, do Steps 8.1 to 8.5

Step 8.1: Increment count by 1

Step 8.2: Initialize k to 1 and while k is less than n, do Steps 8.2.1 to 8.2.4

Step 8.2.1: Increment count by 1

Step 8.2.2: Increment c by 1

Step 8.2.3: Increment count by 1

Step 8.2.4: Multiply k by 2 ( $k = k * 2$ )

Step 8.3: Increment count by 1

Step 8.4: Multiply  $j$  by 2 ( $j = j * 2$ )

Step 9: Increment  $count$  by 1

Step 10: Increment  $count$  by 1

Step 11: Print the value of  $count$

Step 12: Stop

**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){
                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	✓

Passed all tests! ✓

## RESULT:

The above code is executed successfully and gives expected output.

## QUESTION 2.5

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:

Step 1: Start  
Step 2: Input the integer  $n$   
Step 3: Initialize  $counter$  to  $0$  to count operations  
Step 4: Initialize  $rev$  to  $0$  and  $remainder$  as unassigned  
Step 5: Increment  $counter$  by  $1$   
Step 6: While  $n$  is not equal to  $0$ , do Steps 6.1 to 6.7  
Step 6.1: Increment  $counter$  by  $1$   
Step 6.2: Calculate  $remainder$  as  $n \% 10$   
Step 6.3: Increment  $counter$  by  $1$   
Step 6.4: Update  $rev$  to  $rev * 10 + remainder$   
Step 6.5: Increment  $counter$  by  $1$   
Step 6.6: Divide  $n$  by  $10$  ( $n /= 10$ )  
Step 6.7: Increment  $counter$  by  $1$   
Step 7: Increment  $counter$  by  $1$   
Step 8: Increment  $counter$  by  $1$   
Step 9: Print the value of  $counter$   
Step 10: Stop

## **PROGRAM:**

```

#include <stdio.h>
void reverse(int n)
{
    int counter=0;
    int rev = 0, remainder;
    counter++;
    while (n != 0)
    { counter++;
        remainder = n % 10;
        counter++;
        rev = rev * 10 + remainder;
        counter++;
        n/= 10;
        counter++;
    }counter++;
    counter++;
    //print(rev);
    printf("%d",counter);
}
int main(){
    int n;
    scanf("%d",&n);
    reverse(n);
}

```

OUTPUT:

	Input	Expected	Got	
✓	12	11	11	✓
✓	1234	19	19	✓

Passed all tests! ✓

RESULT:

The above code is executed successfully and gives expected output.