

Ex. No: 2

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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:**

```
#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("*");

    {
        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("*");
    }
}

```

```

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  | ✓ |

## 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:**

```
#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 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:**

```
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){

            count++;

            c++;

            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
```