Time Complexity

The amount of time taken by a program to run as a function of length of the input is known as time complexity.

Prog 1 :

Int n;

Cin >> n;

Int a = 0;

for(int i=0; i <= n; i++){

a = a+1;

} // 5 Times the statement executes it self , n = 5

In this Example the running time depends on a = a+1 statement. How many times this statement executes.

Prog 2:

Int n;

Cin >> n;

Int a = 0;

for(int i=0; i <= n; i++){

for (int j=0; i <= n; j++){

a = a+1;

}

} // 25 times the statement executes. , n = 5 n pow 2

Space complexity Related

Space Related: The amount of time taken by a program to run as a function of length of the input. It is directly proportional to the largest memory your program acquires at any the ;largest memory your program acquires at any instance during run time.

1. We need to find out that how it’s related to the input size. Like in Prog 2, There is n pow 2 is relation.

Space calculation of prog 1:

Int occupy 4-byte size. numbers of variables are 3 (n , a ,i) so 4 \* 3 = 12 byte.

Here note that space is constant. So, it is not dependent on input size.

Cases, Best case, Worst Case, Avg Case.

Ex: x = 238

Here in array, if it’s an 1st then best case, not in array or at the last of the array Worst case.

The size of an array is n. and fining x.

The time complexity corresponding to the worst case is **Worst case time complexity**.

The time complexity corresponding to the best case is **Best case time complexity**.

**AVG case time complexity:**

Find all the cases complexity and find the avg of it.

Ex.

Suppose there is an array [a1,a2,a3,…,an] so comparing a1 , comparing a2

No of cases = n

Total comparison = sum of n natural number = (n(n+1))/2

So **AVG case time complexity: =** ((~~n~~(n+1))/2)/~~n~~ = n+1/2

So Here , **BEST Case complexity = constant**

**Worst Case complexity = n+1/2 = ∝ n**

**AVG Case complexity = ∝ n**

How to denote Case complexity

BEST Case complexity = Ω

Worst Case complexity = Big O

AVG Case complexity = θ

For above example of array we can say something like below:

BEST Case complexity = Ω(1)

Worst Case complexity = Big O(n)

AVG Case complexity = θ(n)

Practice Programs.

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