Dev Skill

DevSkill - Competitive Programming - Beginner

Complexity Analysis

Instructor : Md Sadman Sakib

Complexity Analysis

- Time Complexity Analysis
- Space Complexity Analysis

Time Complexity Analysis

- একটা প্রোগ্রাম execute হতে কেমন সময় লাগবে, তা জানা যায়।
- Algorithm এর improvement নিয়ে গবেষণা করা যায়।
- অনেকগুলো Algorithm এর মধ্যে Runtime এর ভিত্তিতে তুলনা করা যায়।

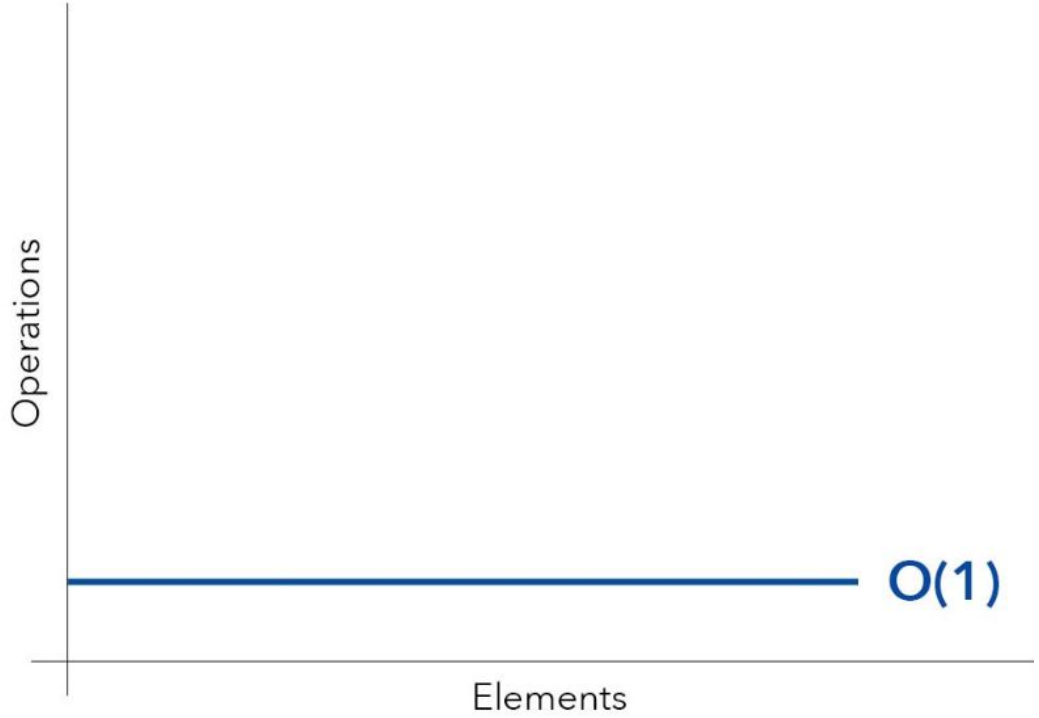
Time Complexity Calculation

Total execution TIME of a program in seconds = (number of executions)/10^8

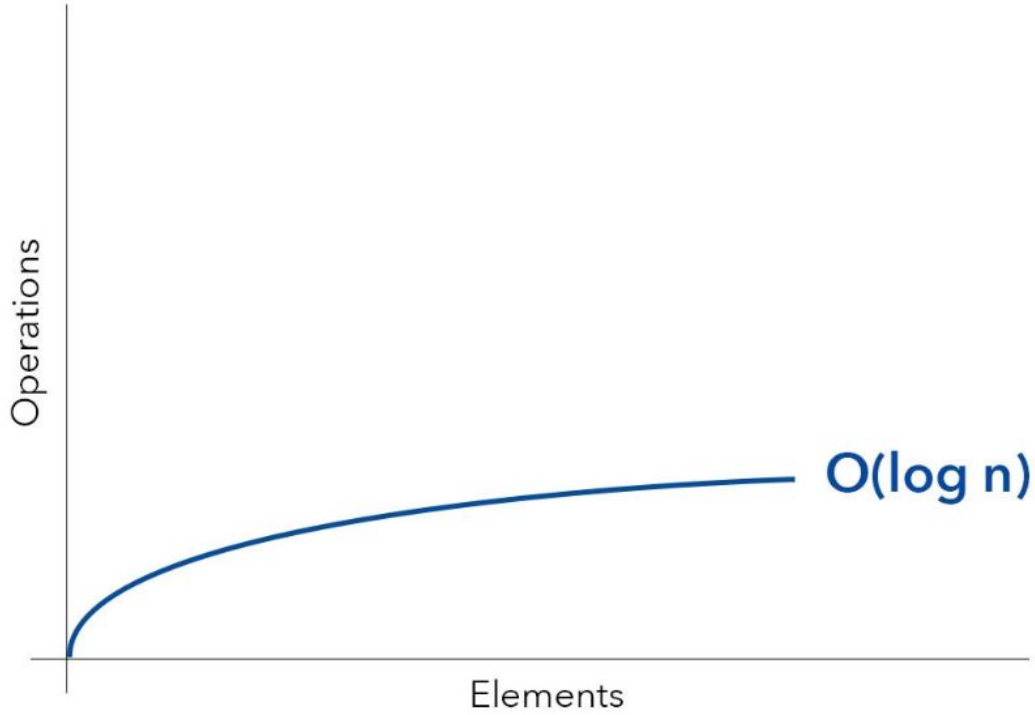
Well known Big-O notation

Big-O Notation	Constraints
O(N) , O(Nlog2(N))	N < 10^6
O(N^2)	N < 10^4
O(1) , O(log2(N))	N < 10^18
O(2^n)	N < 20
O(n!)	N < 11

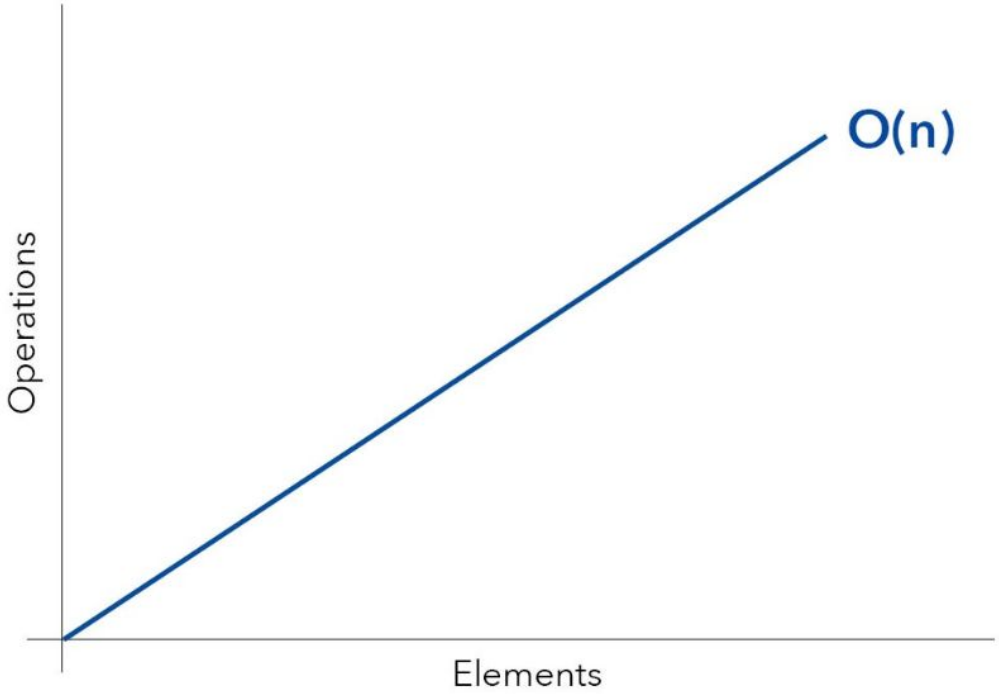
O(1): Your algorithm will run the same, regardless of how many elements are in your list.



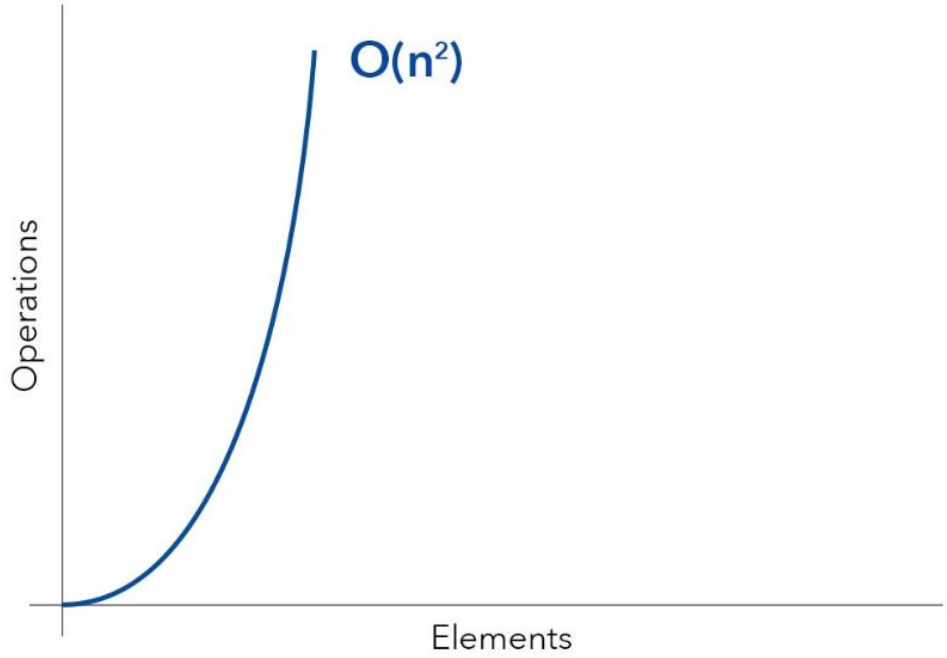
O(log n): The time it takes for your algorithm to run will plateau, no matter how many elements are in your list.



O(n): As the elements in your list increase, the more time it will take for your algorithm to run.



O(n^2): As the elements in your list increase, the time it will take for your algorithm to run will increase exponentially.



Time Complexity Example 1

```
void func1(int N)
{
    for(int t = 1; t<=2; t++)
    {
        for(int i=1; i<=N; i++)
        {
            for(int j=1; j<=N; j++)
            {
                /// some tasks
            }
        }
    }
    for(int i=1; i<=N; i++)
    {
        /// some tasks
    }
    for(int i=1; i<=5; i++)
    {
        /// some tasks
    }
}
```

Time Complexity Example 2

```
void func2(int N)
{
    for(int i=1;i<=N;i++)
    {
        for(int j=1;(1<<j)<=N;j++)
        {
            /// some tasks
        }
    }
}
```

Time Complexity Example 3

```
void func2(int N,int K)
{
    for(int i=1;i<=N;i++)
    {
        if(i==K) break;
    }
}
```

N>K

Space Complexity Analysis

Well known data types and their sizes in C++:

char	1 byte
short int	2 bytes
int	4 bytes
float	4 bytes
double	8 bytes
long long	8 bytes

Questions?