

Analysis of Algorithms

Chapter 1 : Asymptotic Analysis

0xSaad Chapters

Analysis of Algorithms

Introduction

Algorithm is finite set to perform a computation for solving a problem.

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Introduction

N is input size , examples :

- Size of an array
- Polynomial Degree

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Introduction

Worst Case : provides an upper bound

Best Case : provides a lower bound

Average Case : provides a prediction about running time

Lower Bound \leq Running Time \leq Upper Bound

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Time Complexity

Algorithm 1 :

cost
 $arr[0] = 0; C_1$
 $arr[1] = 0; C_1$
 $arr[2] = 0; C_1$

$$C_1 + C_1 + C_1 + \dots$$
$$= C_1 \times N$$

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Time Complexity

Algorithm 2 :

```
for(i=0; i < N; i++)  $C_1$   
    arr[i] = 0;  $C_2$ 
```

$$= C_1 \times (N + 1) + C_2 \times N$$

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Rate of Growth

- $500n^3$ is $O(n^3)$
- $3n$ is $O(n)$
- $n \lg n$ is $O(n \lg n)$

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Prove Questions

1- Show that $6n^2+8n+2$ is $O(n^2)$

$$6n^2 + 8n + 2 \leq cn^2$$

$$6(1)^2 + 8(1) + 2 \leq 17$$

$$6 + 8 + 2 \leq 17 \quad \checkmark$$

$$c = 17$$

$$n_0 = 1$$

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Prove Questions

2- Show that $20n+6$ is $O(n)$

$$\begin{array}{rcl} 20n + 6 & \leq & cn \\ \hline 20n + 6 & \leq & 21n \\ -20 & & -20 \\ \hline 6 & \leq & n \end{array}$$

$$\begin{array}{l} C=21 \\ n_0=6 \end{array} \checkmark$$

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Prove Questions

2- Show that $20n+6$ is $O(n)$

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