CS & IT ENGINEERING

Algorithms

Analysis of Algorithm

Lecture No.- 02

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Recap of Previous Lecture

- Topic: Introduction to Course
- Topic: Algorithm Concept
- Topic: Algorithm Lifecycle Steps
- Topic
- Topic
- Topic

$x = y + z$

Statements/Steps → (Fund. Basic opn)

Design & Analysis

Topics to be Covered

Topics

- Need for Analysis [what & why]
- Methodology of Analysis [How]
- Types of Analysis

Topic: Analysis of Algorithms

Need for analysis (Why?)

1) To determine Resource Consumption (What)

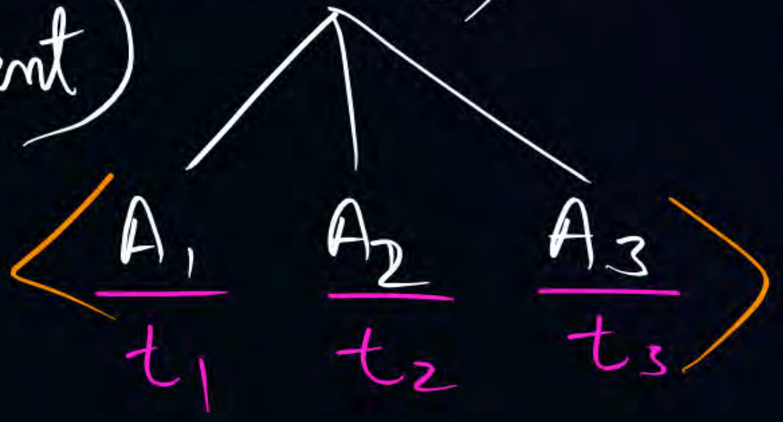
<Time + Space + Registers + Cost + ...>

(PC - Domain)

2) Performance (Time)

* Comparison to find out efficient soln (Algo) (Efficient)

Problem (P)



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Methodology of Analysis (How)

↳ (Time Complexity)

1. [x ← y + z]

(0.5 ns)

- Language } s/w
- O.S
- H/W } < CPU + Memory + IO >

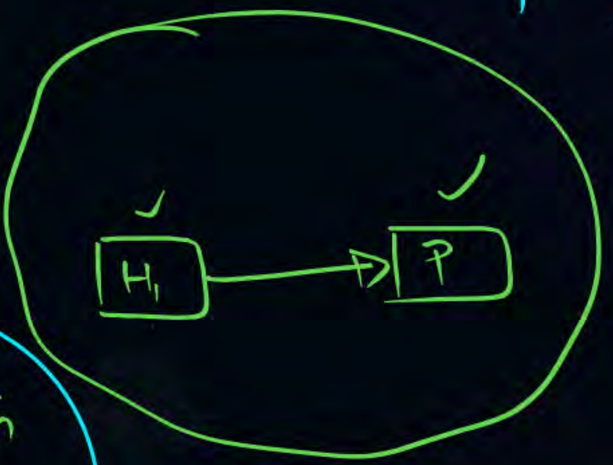
Platform

Environment

↓

Aposterior

① Analysis



Mode
- Walk : 30 m
- Cycle : 20 m
- Bike : 10 m
- Car : 6 m
- fly

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Aposterion Analysis [Platform dependent (H/W, S/W)]

Advantages

1) It gives exact values in real Units

Drawbacks/Limitation

1) It is difficult to carry out; (Manual work)
2) Cannot Consider for all Cases of IP's; (Inputs)
3) Non-Uniformity:

"Performance Comparison becomes difficult"

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2) Apriori Analysis

[Platform Independent]

Analytic Framework:

→ Take into account all possible IP's;

→ Allows us to calculate the relative efficiency (Perfo) of Two Algo's in a way that is independent of Platform

→ Can be Carried out by Studying the High level description of Algorithm without actual Implementation;

→ It is easy to Carry out;

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Drawback:

→ Will not give real/actual values in units

→ Estimates/Approximates

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Components of Analytic Framework:

1) A language (Pseudo) for describing Algorithm steps

$a = b + c;$

$a \leftarrow b + c$

2) A Computation Model that the Algorithm executes within it;

3) A metric for measuring Algo running Time;

4) An approach/Notation to characterize running Time;

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Step-count

RAM Model of Computation

(Hyp. m/c)

Memory

CPU

Each Fund. opn / Basic opn takes one unit of Time

Algorithm Test

```
{
1. x ← y + z;                          2 units (const)
2. for i ← 1 to n
       <a ← b + c>
3. for i ← 1 to n
   {
n →    for j ← 1 to n
           K ← K + m;
   }
}
```

i++ ; 3 (n)

for i ← 1 to 3

3 Inc. { i=1, i=2, i=3, i=4 } 4, Comps (n+1)

$\left[\underline{1} + \overline{(n+1)} + \underline{n} + \underline{n} + \underline{n}\right] = (4n+2)$

$\left(\underline{1} + (\underline{n+1}) + \underline{n} : i \right.$
$\left. + \underline{n} + (n+1)\cdot n + n\cdot n : j \right.$
$\left. + n\cdot n + n\cdot n \right)$

$= 4n^2 + 4n + 2$

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$$Time = 2 + (4n+2) + (4n^2+4n+2)$$

$$Time = (4n^2 + 8n + 6) \text{ units}$$

n : (input size)

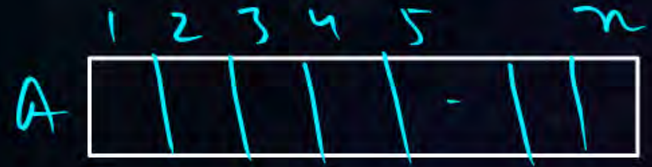
ASN / Notation

$$\rightarrow O(n^2)$$

Repr. the Time

(Comparison) → metric

Linear_Search



(n)

THANK - YOU