CS & IT ENGINEERING

Algorithm

Analysis of Algorithms

Lecture No.- 02

By- Aditya sir

Recap of Previous Lecture

Topic Introduction to course

Topic Algorithm Concept

Topic Algorithm Lifecycle Steps

P & A

Topics to be Covered

- **Topic** Need to Analysis [why & what]
- **Topic** Methodology of Analysis [How?]
- **Topic** Types of Analysis

Topic : Analysis of Algorithms

Need for Analysis (why?)

1. To Determine Resource Consumption

(what)

< Time, Space, Cost, Bandwidth... >

2. Performance comparison to find out efficient algorithm

(why?)

Noida → Jaipur

① Flight
② Car
③ Train ④ Bus

Maggi

Utensil

Oven

Call & chef

time Complexity

Space Complexity

Noida ⟶ Jaipur

① Train

② Flight

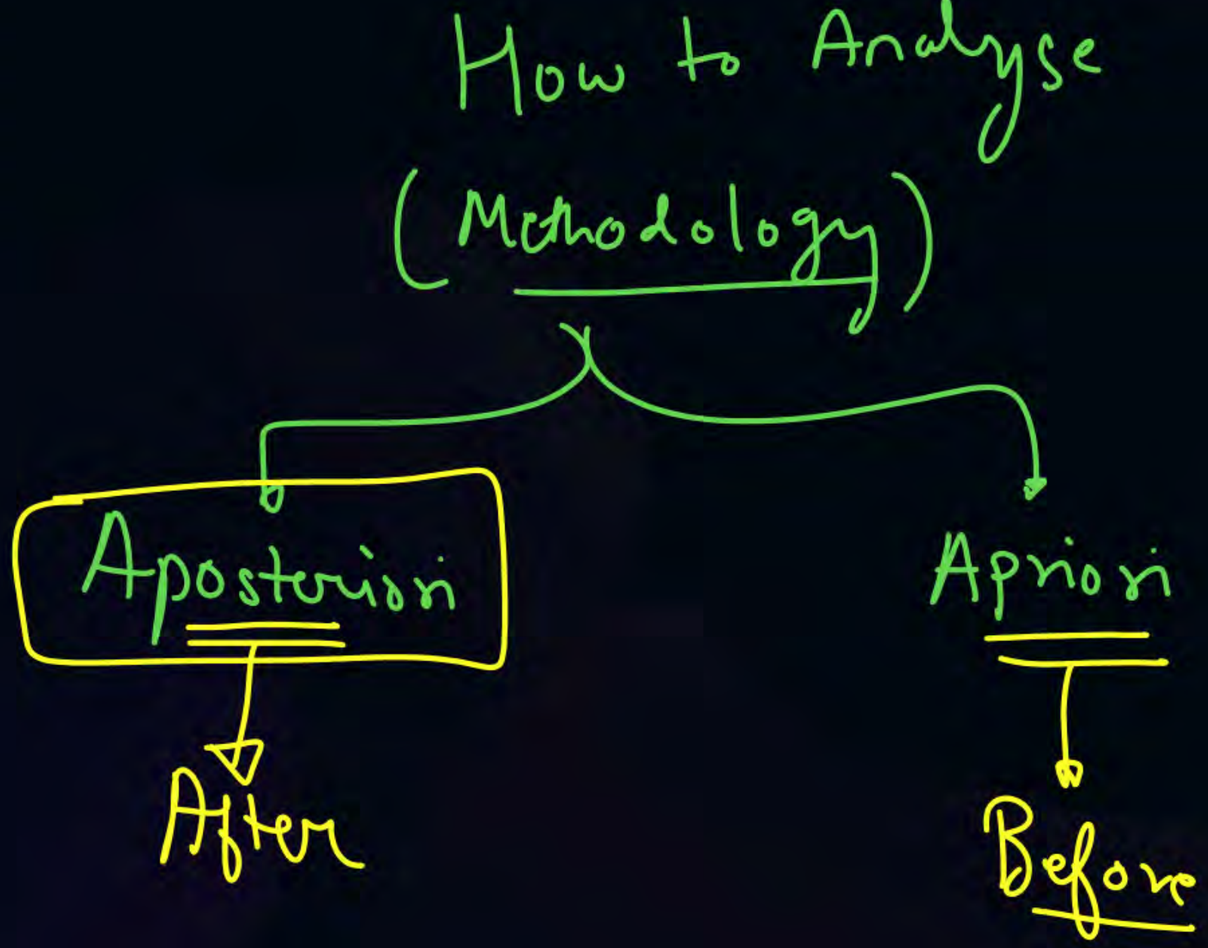
③ Car

28th June 24

30th June 24

30th

Cars


How to Analyse
(Methodology)
Aposterion
After
Apriori
Before

① Aposterior Analysis

↳ Depends upon

① Environment
② Platforms

H → Human

L → Computer

Depends upon: $a = b * c$

① Programming lang

② OS (Mac, Windows, linux)

③ Hardware → (CPU, memory etc.)

Noida ⟶ Jaipur

How?

① Flight → 2 hr

② Train → 10 hrs

③ Car → 15 hrs

④ Walk →

A posteriori Analysis

S/w
H/w
→ performance comparison becomes Difficult.

Advantages

1. It gives us exact value in real units

Drawbacks /Limitation

1. It is difficult to carry out.
2. Cannot consider for all cases of inputs.
3. Platform Dependent

Topic : Analysis of Algorithms

~~A posteriori Analysis~~

A priori Analysis → Platform (I)ndependent

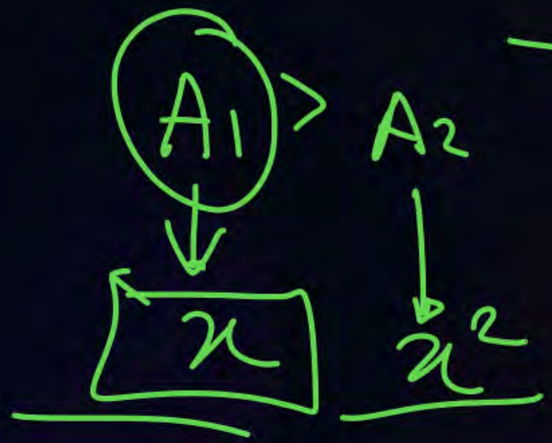
Analytic Framework:

1. Takes into account all the possible inputs.
2. It allows us to Compare the relative efficiency/(Performance) of two Algorithms
3. It can be Carried out by studying the high level description of Algo without actual implementation.
4. It is easy to carry out

Topic : Analysis of Algorithms

Drawback: Apriori Analysis

① Will not give real/actual values in units



→ Estimate / Approximate

Topic : Analysis of Algorithms

Components of Analytic Framework:

1. Need a Pseudo language for Describing Algo steps

   $a = b + c$
   $a \leftarrow b + c$

2. A computational model that the Algo executes within it

3. A metric for measuring Algo running time

4. A notation to categorize this running time.

Topic : Analysis of Algorithms

```
Algorithm Test (n)
{
    1.  a = b + c
}
```

2 units (const)

CPU / memory

Each fundamental operation takes 1 unit time.

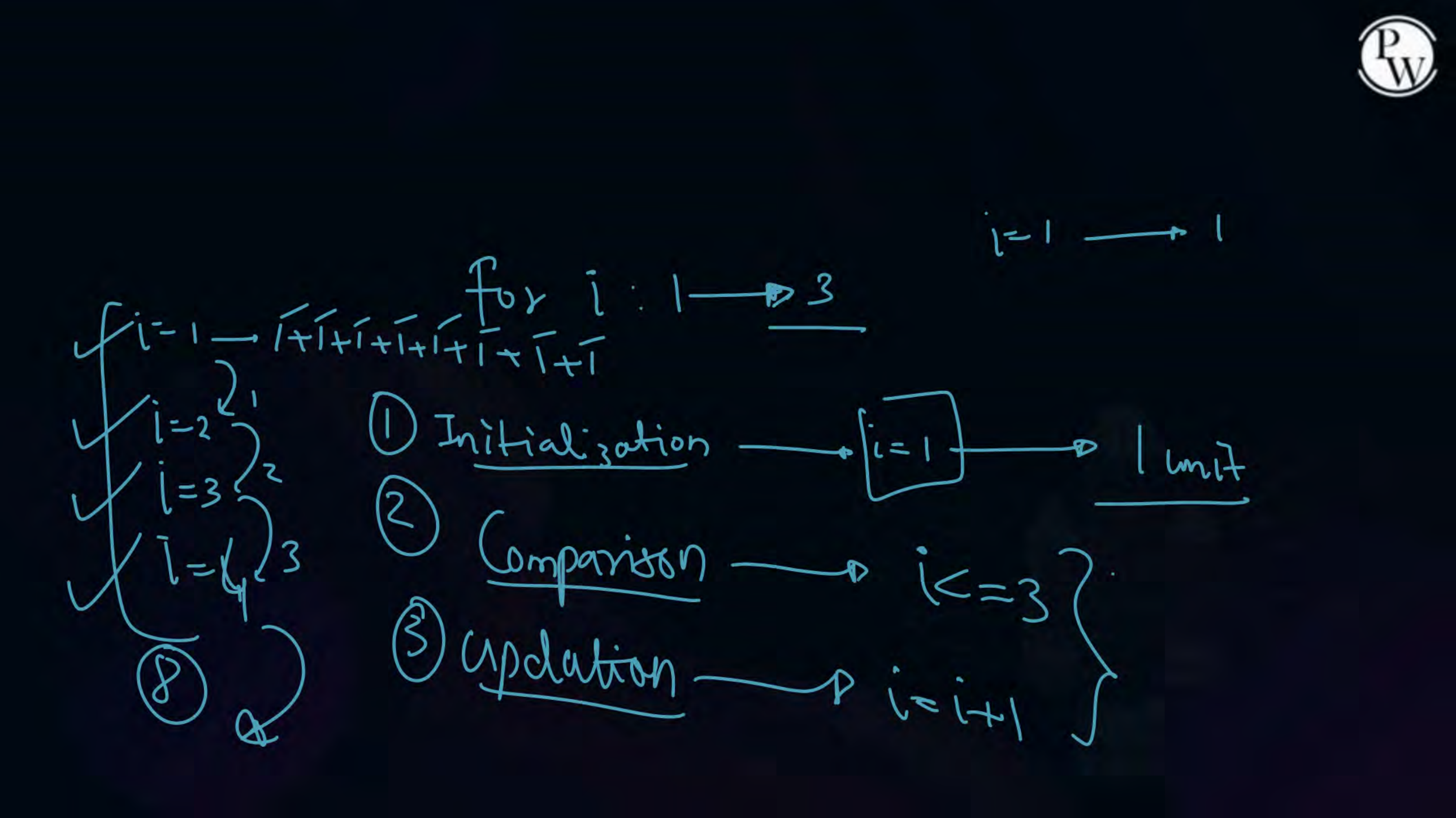
```
2.  for i : 1 ⟶ n
        a = b + c
```

1 + (n+1) + n + = 4n+2

2n

```
3.  for i : 1 ⟶ n
        for j : 1 ⟶ n
            a = b + c
}
```

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

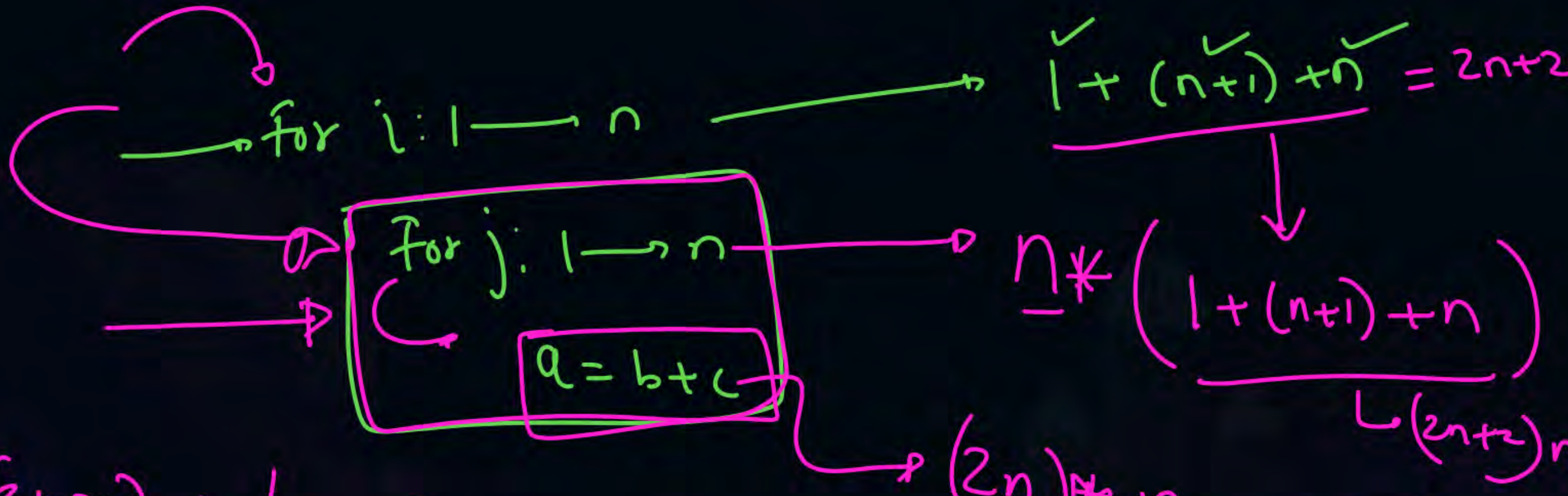

for i : 1 ⟶ 3
i = 1 ⟶ 1
i = 1 ⟶ 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1
i = 2
i = 3
i = 4
1
2
3
8
① Initialization ⟶ i = 1 ⟶ 1 time
② Comparison ⟶ i <= 3
③ updation ⟶ i = i + 1

for i : 1 ⟶ n :

① initialization : ⟶ 1

② Comparison : ⟶ n+1

③ Updation : ⟶ n



$\Rightarrow (2n+2) + (2n+2)*n + 2n^2$

$\Rightarrow 4n^2 + 4n + 2$

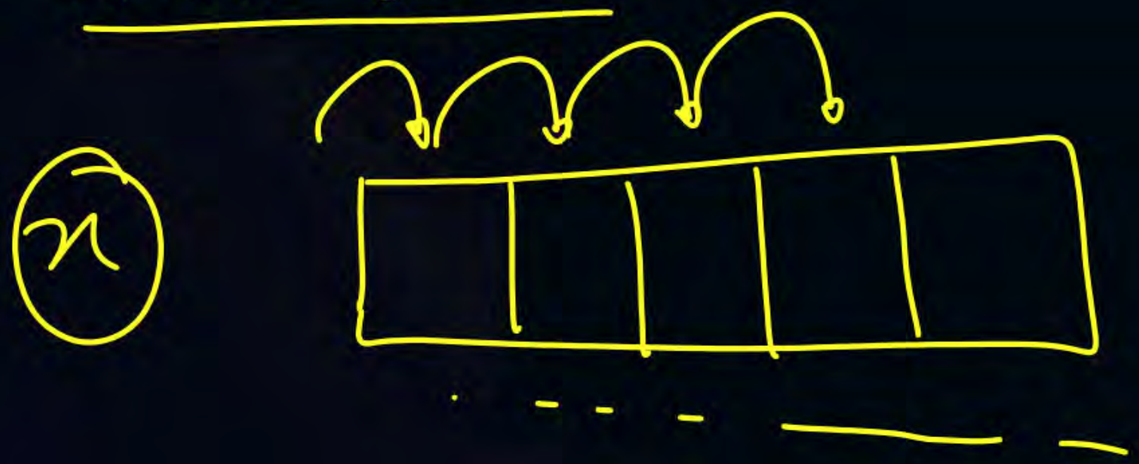
Total time :- $2 + (4n+2) + (4n^2+4n+2)$

$= (4n^2 + 8n^1 + 6)$ units

Asymptotic Notation

$O(n^2)$ → next lec

Linear Search



2 mins Summary

Topic Need for analysis (How, What and Why)

Topic Analysis Methodology

Topic Examples

THANK - YOU