

Q

Saad \longrightarrow 5 Secs (5 GHz)

Vibhuti \longrightarrow 10 Secs (2.5 GHz)

Who wrote better Algo?

We can't conclude Anything

1 GHz \Rightarrow 10^9 ops per Second

* Efficiency / TC complexity \Rightarrow Num-ops

Algo A \Rightarrow 100 ops \checkmark

Algo B \Rightarrow 200 ops

Big O (Asymptotic TC)

\Rightarrow Measure TC as Trend of Equation
of Num-Ops

Big O

① Take only the term with Highest degree

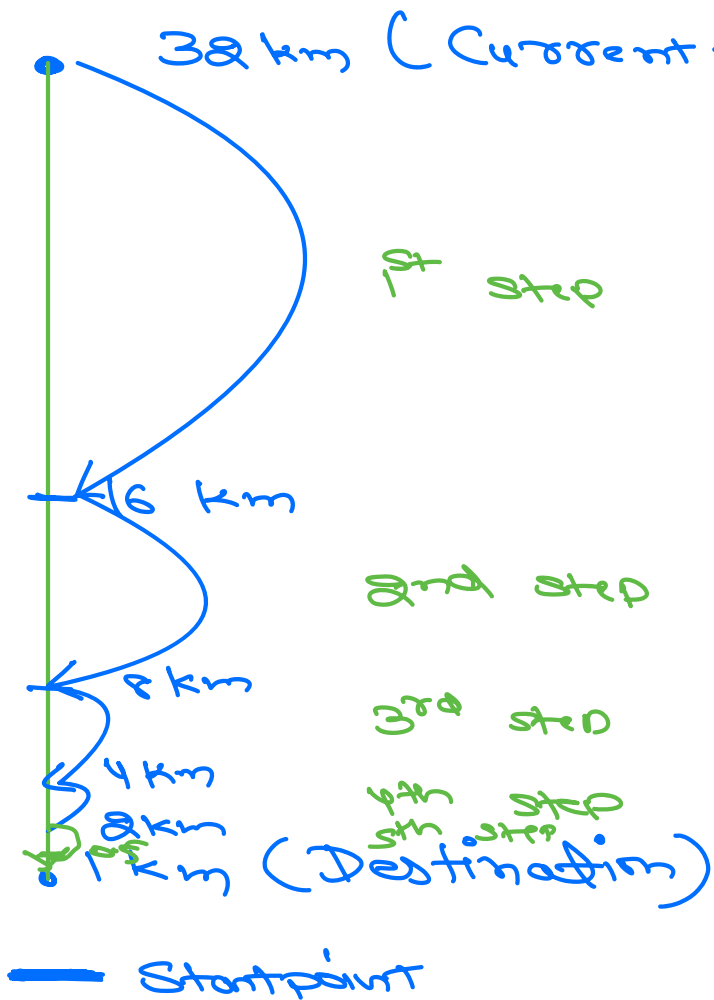
$$n^2 + n + c \Rightarrow O(n^2)$$

\downarrow
Quadratic

② Ignore coefficient and constant

$$\underbrace{5n^3}_{\checkmark} + \underbrace{3n^2}_X + \underbrace{2n^2}_X + \underbrace{100n}_X + \underbrace{c}_X \Rightarrow O(n^3)$$

Log TC



$$\log_2 32 \Rightarrow 5$$

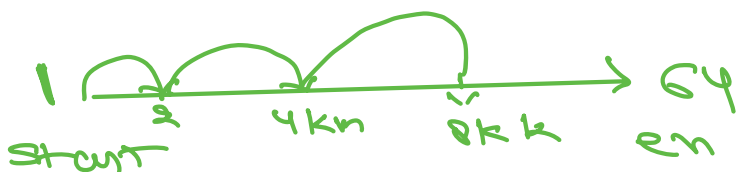
$$\log_2 2^5$$

$$5 \times \log_2 2$$

$$5 \times 1 \Rightarrow 5$$

$$2 \times 2 \times 2 \times 2 \times 2$$

$$\log_2 n \Rightarrow 1$$



$$\log_2 64 \Rightarrow 6 \times \log_2 2 \Rightarrow 6 \text{ steps}$$

Binary Search

* Divide and Conquer
Array

10 20 33 67 98 101

→ → → → →

Target \Rightarrow 20

* $TC : O(n)$

* Linear Search

* Works with all
kind of DS/Lists

* Since the array is sorted we can
implement Binary Search $TC = \log_2 N$

10 20 33 67 98 101

← ✓ →

Cur. pos
 $T = 20$

idea \Rightarrow

10 20 33 67 98 101

↙ ↓ ↘
Target \Rightarrow -5 X

① initialize 2 pointers

lo, hi \Rightarrow 0, 5



↑
0th index

↑
5th index

Keep

Discard

② Calculate Mid-point

$$\text{mid} \Rightarrow \frac{(0+5)}{2}$$

③ Check and Update

lo \Rightarrow mid + 1

or

hi \Rightarrow mid - 1



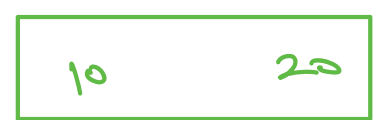
↑
lo

mid

↑
High

✓

✗



lo

hi = mid - 1

For left hand side \Rightarrow [mid] > Target



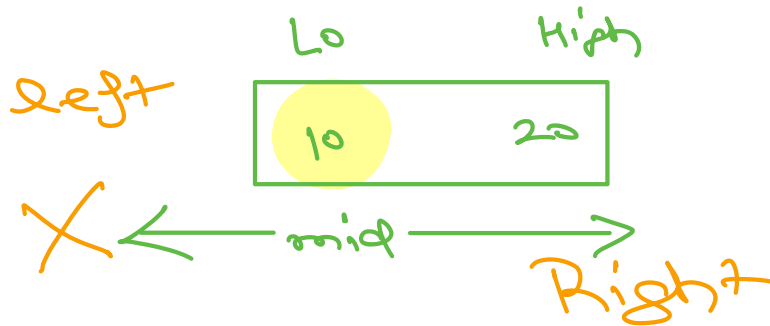
lo

hi = mid - 1

0

1

mid $\Rightarrow (0+1)/2 \Rightarrow 0$



[mid] < Target

lo = mid + 1

Keep RH. 5

③



lo, hi $\Rightarrow 1, 1$

mid $\Rightarrow 1$

[mid] == Target ✓

return mid

* Target 23

20

lo, mid, high

$[mid] < Target$

R.H.S $\Rightarrow lo \Rightarrow mid + 1$

lo \geq 2 , hi \leq 1 Pointers crossed

lo $>$ High
return "Not Found"

TC $\log_2 N$

64 element

approx 6 steps