

# Algorithms

## # Linear Search

$$O(n)$$

5	3	4	1	7	9
---	---	---	---	---	---

$t=7$

-1

→ Find position of the target element in the given array. If the element is not present set -1.

## # Binary Search

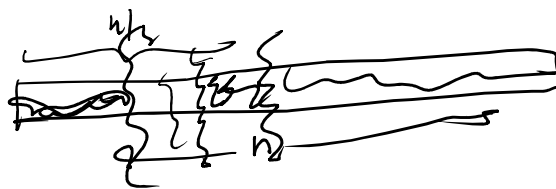
3	4	6	8	9	11	13
---	---	---	---	---	----	----

8

$$mid = \left( \frac{s+t}{2} \right)$$

$$O(n)$$

$t=11$



$$O(\log n)$$

$$n \rightarrow n/2 \rightarrow n/4 \rightarrow \dots \rightarrow 1$$

$$\log_2 n$$

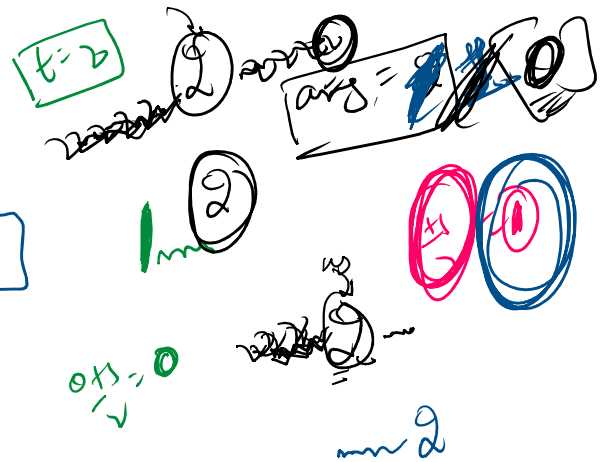
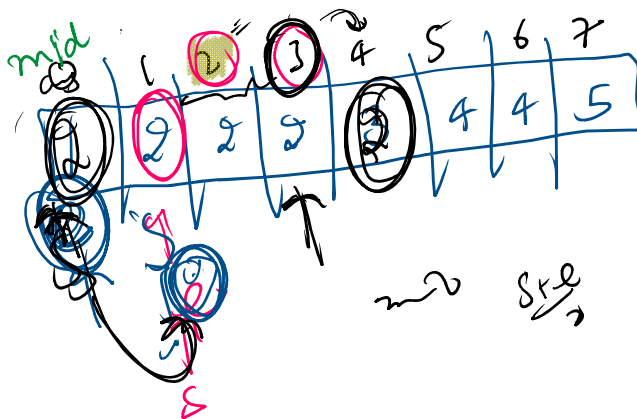
$$f(n) = n, i = 1, i = n/2$$

$$O(n) \rightarrow O(\log n)$$

⊛ When ever question is on array and expected T.C is  $\log n$   
 think Binary search.

⊛ When the loop of Binary search ends, ' $\underline{S}$ '  
 tells the position of the target  
 अगर वो array mein present hoga

# Starting and Ending Index



# Binary Search on 2D matrix

	0	1	2
0	10	20	30
1	40	50	60
2	70	80	90

0	1	2	3	4	5	6	7	8
10	20	30	40	50	60	70	80	90

$$S = 0$$

$$e = 8$$

$$m = \frac{S+e}{2}$$

$$\left[ \frac{m}{m}, m \% m \right]$$

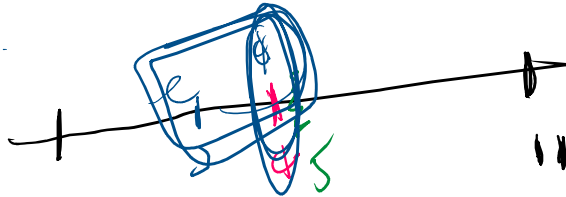
$$(4)$$

$$1, 3$$

$$l \quad m \quad \begin{array}{r} 4 \\ 3 \end{array} \quad 1, 1, 1$$

# Square root of a number

mid



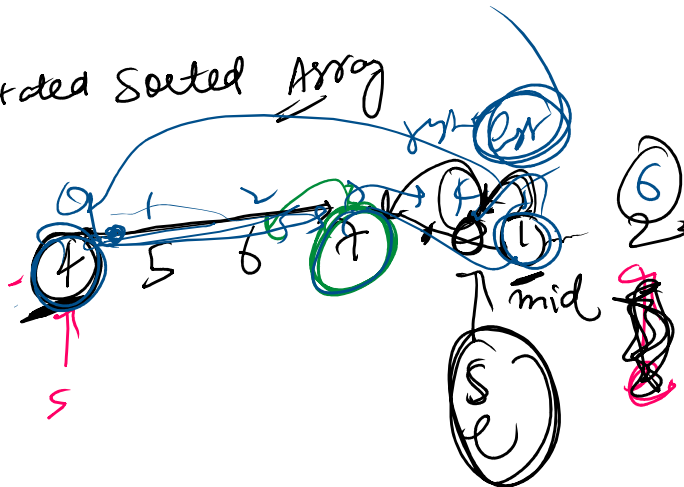
$$\text{int mid} = \left( \frac{s + e}{2} \right)$$

avoids overflow

$$\text{int mid} = s + \frac{e - s}{2}$$

$$\frac{2s + e - s}{2} = \frac{s + e}{2}$$

# Min in Rotated Sorted Array



$$\frac{s + e}{2}$$

s + e

$$\text{mid} \leq \text{mid} \Rightarrow$$



