Binary Search

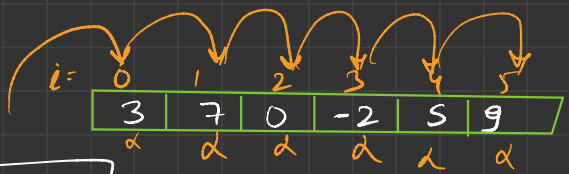
→ Linear Search → n - size

worst case → n comparision

array → 1000 values

L.S → worst case

1000 comparision



Key = 2 → absent / Not found

```
For (0 -> n)
{
    if (arr[i] == key)
    {
        return i;
    }
}
return -1;
```

T.C → O(n)

Binary Search

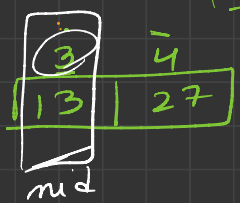
cond^n
↓
element should be in monotonic function

Ex:

0	1	2	3	4
3	5	9	13	27

① find mid
② compare mid / key
③ = → return index
!= → part decide

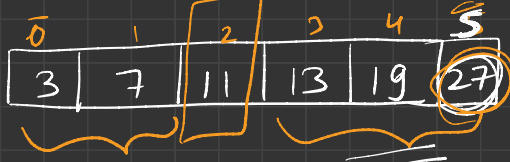
key = 13



mid = (s+e)/2
= (3+4)/2
= 7/2 = 3

13 == 13
↓
True → return Index

ans = 3



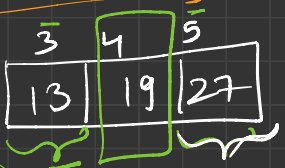
Key = 27

$mid = \left(\frac{s+e}{2}\right) = \left(\frac{0+5}{2}\right) = \frac{5}{2} = 2$

→ mid
→ Compare
→ = → Return
→ != → part decide

11 != 27

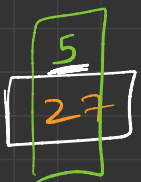
27 > 11



19 != 27

27 > 19

$mid = \left(\frac{3+5}{2}\right) = \frac{8}{2} = 4$

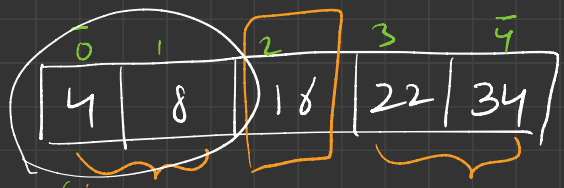


$mid = \left(\frac{s+e}{2}\right) = \left(\frac{5+5}{2}\right) = 5$

27 == 27 → True

return 5;

ans = 5

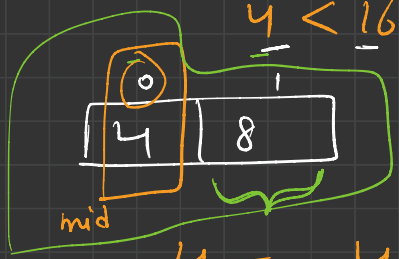


Key 4

$mid = \left(\frac{0+4}{2}\right) = \frac{4}{2} = 2$

$16 != 4$

$4 < 16$



$mid = \left(\frac{s+e}{2}\right) = \frac{0+1}{2} = 0$

Key 8

$4 != 8$

$8 > 4$

$4 == 4$

TRUE

return 0;

ans = 0

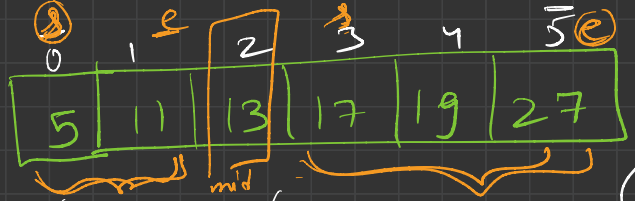
$mid = \left(\frac{s+e}{2}\right) = \left(\frac{1+1}{2}\right) = 1$

$8 == 8$

TRUE

return 1;

ans = 1



$mid = \left(\frac{s+e}{2}\right) = \left(\frac{0+5}{2}\right) = \frac{5}{2} = 2$

s = mid + 1

key 25

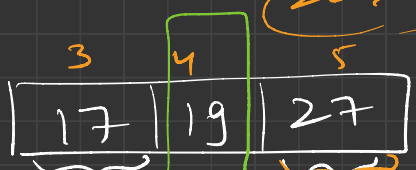
e = mid - 1

13 != 25

25 > 13

left → e = mid - 1

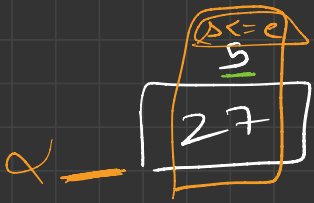
right → s = mid + 1



$mid = \left(\frac{s+e}{2}\right) = \left(\frac{3+5}{2}\right) = \frac{8}{2} = 4$

19 != 25

25 > 19



s > e ✗

$mid = \left(\frac{s+e}{2}\right) = \left(\frac{5+5}{2}\right) = 5$

27 != 25 ✗

25 < 27

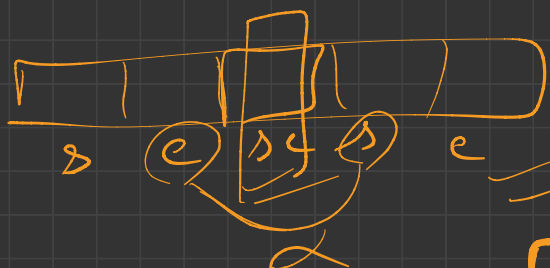
return -1;

NOT FOUND

$s = 0, \quad e = n-1$ (n → size)

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

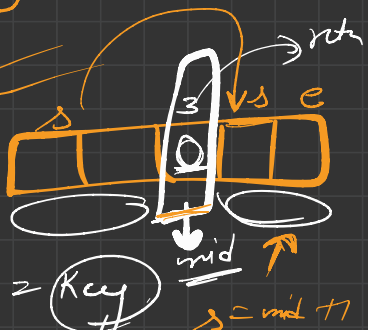
Until not start <= end / s <= e



while (s <= e)

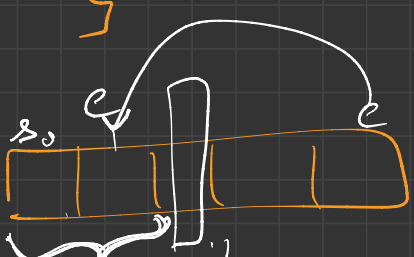
{

arr[mid] == Key



Key < arr[mid]

left



e = mid - 1

?

mid = (start + end) / 2

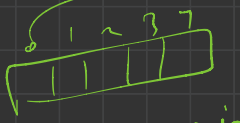
$$mid = \frac{(start + end)}{2}$$

int → $2^{31} - 1$

start = $2^{31} - 1$ → Value

end = $2^{31} - 1$ ↓

Int range ka baton



$$mid = \frac{(s + e)}{2}$$

$$\Rightarrow s + \left(\frac{e - s}{2}\right)$$ → Chalaki

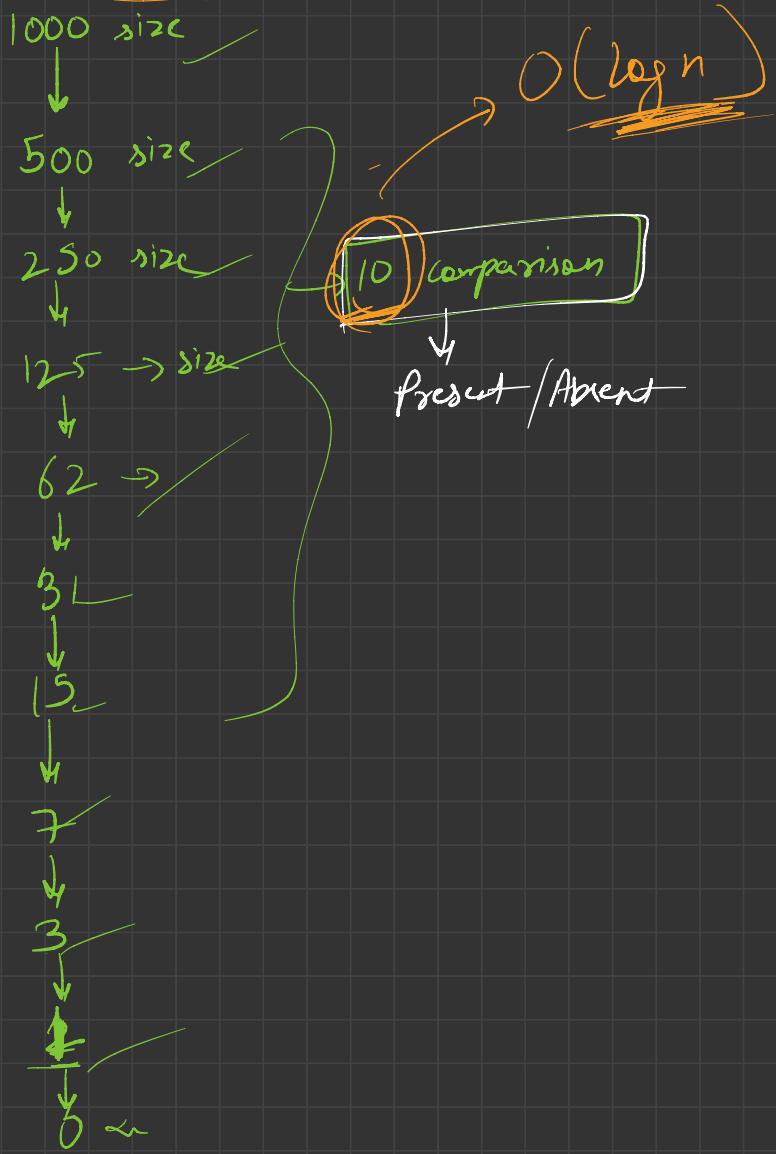
$$= s + \frac{e}{2} - \frac{s}{2}$$

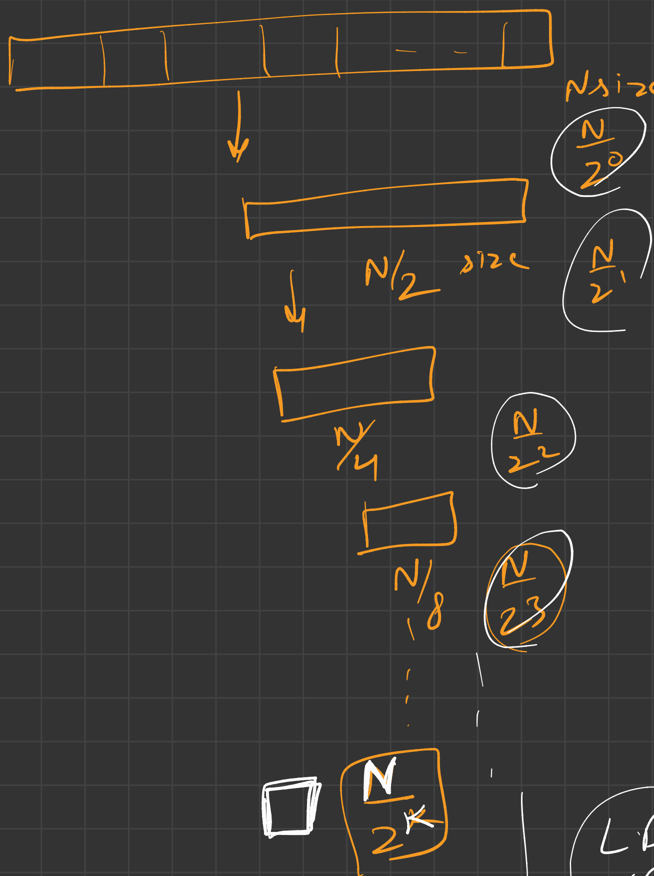
$$= \frac{s}{2} + \frac{e}{2} \times 2 \left(\frac{s+e}{2}\right)$$

→ L·S → 1000 values → array

worst case → 1000 comparison → O(n)

→ B·S → 1000 value → sorted array





$$\frac{N}{2^K} = 1$$

$$N = 2^K$$

$$K = \log N$$

$$O(\log N)$$

LB
UB → No. of Occurrences

Pivot

Rotated S.

Search type of

Agg Cow

ROTI

PRATA

BOOK