

Number Scale from 1 - 5, assume all no are missing

1 2 3 4 5

↳ what is the 5th missing Number?

It will be 5

Now assume we are given an array which represents the array whose numbers are not missing [2 3 4 7]

1 (2) 3 4 5

↓

If 2 is present → Our 5th missing number will increase by 1 → 1 3 4 5 6

1 (3) 4 5 6

↓

3 is present → Our 5th missing number will increase by 1

1 4 5 6 7

1 (4) 5 6 7

↓

Present → increase by 1 → 1 5 6 7 8

1 5 6 (7) 8

↓

7 is present → increase by 1 → 1 5 6 8 9

Now these [1 5 6 8 9] are our missing numbers
out of which 5th missing number is 9

$K=5$

Missing:

$$\text{arr}[\text{high}] - [\text{high}+1]$$

1 ② 3 4 5



Pr

remaining =

$K - \text{Missing}$

1 ③ 4 5 6 = $K - (\text{arr}[\text{high}] - [\text{high}+1])$



Pr

required

1 ④ 5 6 7 $\text{arr}[\text{high}] + K - (\text{arr}[\text{high}] - [\text{high}+1])$

Pr

$$= \text{arr}[\text{high}] + K - \text{arr}[\text{high}] + [\text{high}+1]$$

1 5 6 ⑦ 8 = $K + \underline{\text{high}+1}$



Pr

1 5 6 7 8 9

② Optimal solution.

→ For $k=5$, the actual number would be 1 2 3 4 5
But 2 3 4 7 11 are present.

- Actual No
if Everything was missing [1 2 3 4 5]
- Numbers that are present [2 3 4 7 11]
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $2-1 \quad 3-2 \quad 4-3 \quad 7-4 \quad 11-5$
- Total # of missing Number [1 1 1 3 6]

So: [2 3 4 7 11]
1 1 1 3 6

Consider we at 7 after we found the index b/n which the missing number is present

so in that case right = 7, left = 1

right
[1 2 3 4 5
2 3 4 7 11]

1 1 1 3 6

Calculate Missing No: $7 - 4 = 3$

$$\text{ans}[right] - (right + 1)$$

Total # of missing Number Until right = $\text{ans}[right] - [right + 1]$

- ①

so from the current No, how many more no do we need to find 5th missing no.

At 7 → we have 3 missing number.

so we need 3 more

How: $5 - 3 = 2$.

$K = 5$

$$\text{arr}[\text{right}] - [\text{right} + 1] = 3 \quad \# \text{ from eq - ①}$$

so: $K - [\text{arr}[\text{right}] - [\text{right} + 1]] = \text{Additional Missing No}$
Appending $\underbrace{\qquad\qquad\qquad}_{5 - 3 = 2} \quad \textcircled{2}$

Now to get the actual kth/5th missing Number

We will do $7 + 2 = 9$

$\downarrow \quad \downarrow$
Number Additional Missing No

We know: $\text{arr}[\text{right}] = 7 \quad \text{--- } \textcircled{i}$

using Equation 2:

$$K - [\text{arr}[\text{right}] - [\text{right} + 1]] \quad \text{--- } \textcircled{ii}$$

Combining i & ii we get :

$$\text{arr}[\text{right}] + K - [\text{arr}[\text{right}] - [\text{right} + 1]]$$

$$= \text{arr}[\text{right}] + K - \text{arr}[\text{right}] + [\text{right} + 1]$$

$$= K + \text{right} + 1 //$$

we can also write that as

$k + \text{left}$

why? we know that left will always be $\text{right} + 1$, after the end of Binary Search

so we can replace

$k + \text{right} + 1$ with

$k + \text{low}$