First Missing Positive (Leetcode-41)

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Leetcode [41] First missing positive no.

Ex1 Nums

1	2	3	4	5	6	7
0	1	2	3	4	5	6

output: 8

We must write Algo in T.C. = O(N) & S.C. = O(1)

Ex2 Nums

2	-5	0	11	1	-7	10
0	1	2	3	4	5	6

output: 3

Ex3 Nums

2	3	0	1 1	1	-7	3
0	1	2	3	4	5	6

output: 4

Note → I observed ki Ans ∈ [1, N+1] where N = nums.size()

Approach 1 (X)

Linear search

for(0 to n) { → Traverse ⇒ O(N) } > T.C. = O(N²)
  for(0 to n) { → Search ⇒ O(N)
  }
}

S.C. = O(1)

Approach 2 (X)

Hashing + searching

for(0 to N) { → Traverse ⇒ O(N)
}

T.C. = O(N)

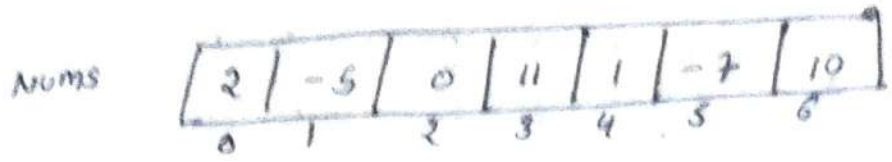
Hash

-	-	-

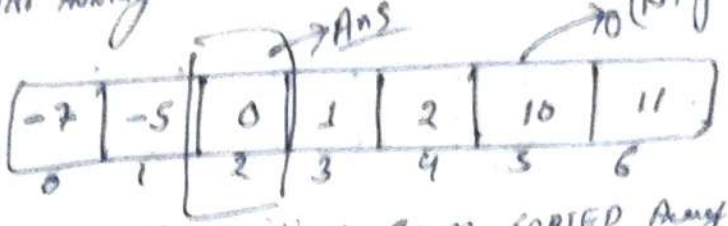
linear search ⇒ O(1)

Hash takes space ⇒ S.C. = O(N)

Approach 3 Sorting



STEP1 SORT Array



STEP2 Find First position from SORTED Array

Note: Ans ∈ [1, N+1]

int Ans = N+1 → O(N)

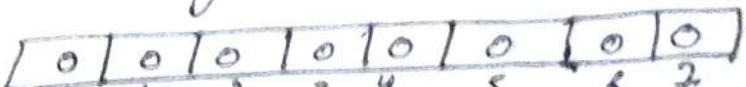
```
for(0 to N){
    if(nums[i] > Ans){
        Ans = i+1;
        break;
    }
}
return Ans → (2+1=3)
```

T.C = O(N) + O(NlogN)
= O(NlogN)
S.C = O(N)

Approach 4 pigeonHole Principal (in other place)

N=7 STEP1 Create an array of size (N+1) & Initialize with 0

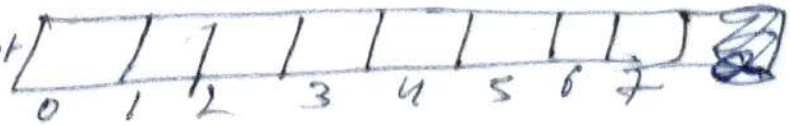
size=8 → Seat



STEP2 Place values at correct positions

[SeatIndex = Element - 1
= nums[i] - 1]

Seat[seatIndex] = Element] when Element > 0



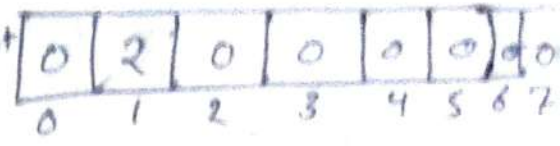
Elmt = 2

seatIndex = Elmt - 1

⇒ 2 - 1 = 1

seat[seatIndex] = Elmt

seat[1] = 2



Elmt = -5 Ignore ✗

Elmt = 0 Ignore ✗

Elmt = 11 Ignore ✗

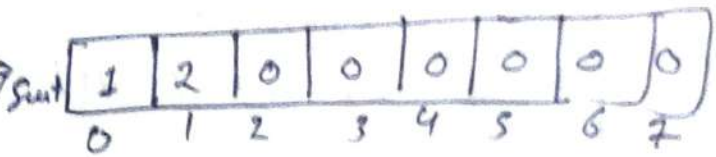
↳ 11 > 8

Elmt = 1

seatIndex = 1 - 1

= 0

seat[0] = 1



Elmt = -7 ✗

Elmt = 10 ✗

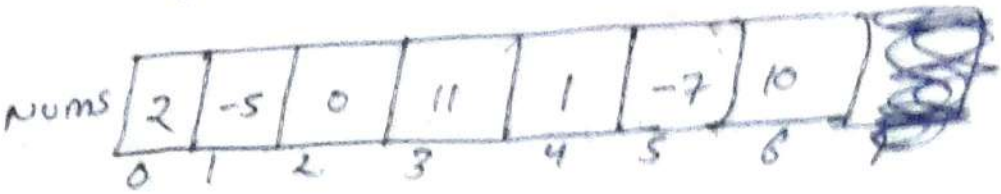
STEP3 Find First positive from seat Arr

```
int Ans = N+1
for(0 to N) {
    if(seat[i] > Ans) {
        Ans = i+1
        break
    }
}
return Ans
```

T.C. = O(N)

S.C. = O(N)

Approach 5 pigeonHole principal (in place)

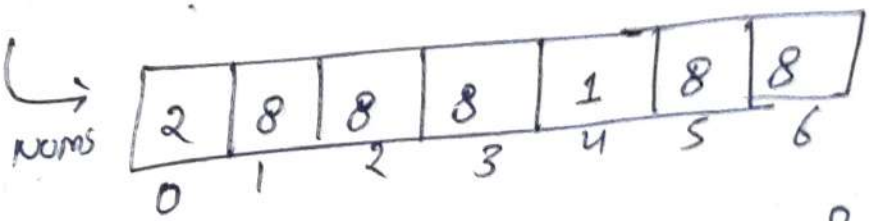


N=7
Ans ∈ [1,8]

STEP1 modify the input Array's value with new val (N+1)

Why N+1 value?
(Kyonki last possible Ans ki value N+1 ho sakti hai jab koi bhi value array me as small position na mile)

for(0 to N) {
  if(nums[i]<=0 || nums[i]>N) {
    → nums[i] = N+1
  }
}



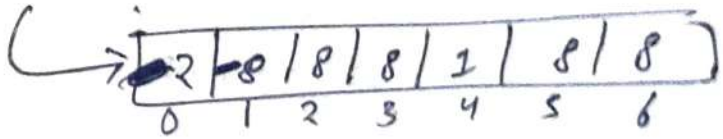
STEP2 marking as visited [-ve ⇒ visited, +ve ⇒ no visited]

Elmt = 2

int Indx = Elmt - 1 ⇒ 2-1 ⇒ 1

nums[Indx] *= -1

nums[1] *= -1

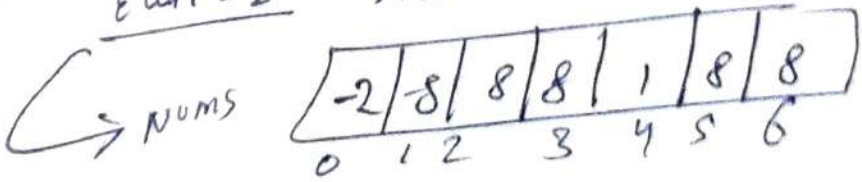


Elmt = 8

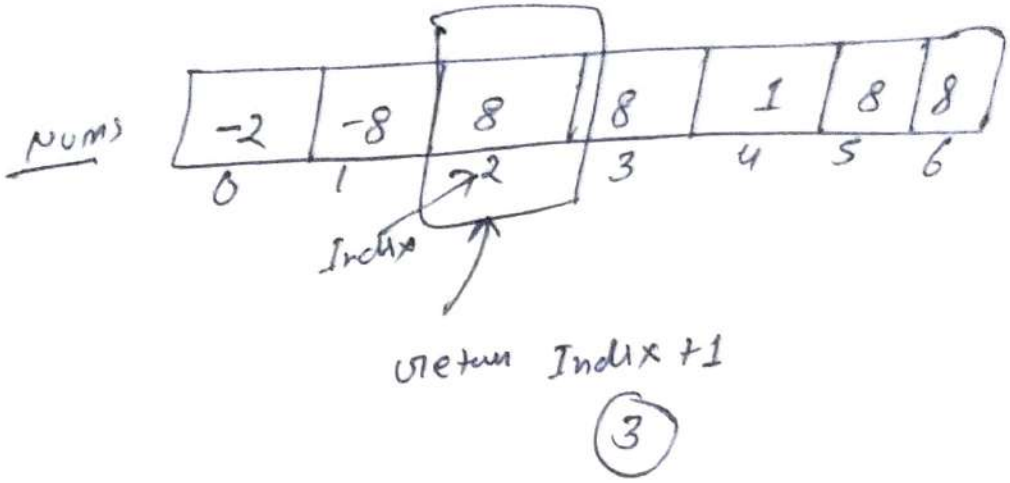
Ignore ✗

~~Indx = 8-1~~

Elmt = 1 Indx = 1-1 = 0



STEP 3 Find First positive



T.C. ⇒ STEP1 + STEP2 + STEP3

O(N) + O(N) + O(N) ⇒ O(N)

S.C ⇒ O(1)

T.C. = O(N)

S.C. = O(1)

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