Bonus - 7
Final Problem Solving

The last one :/

RECAP

Let’s get started!

1. K-Query

(KQUERY)

K ⇒ constant

(l, r)

b → a[i] > K ⇒ 1

b → a[i] ≤ K ⇒ 0

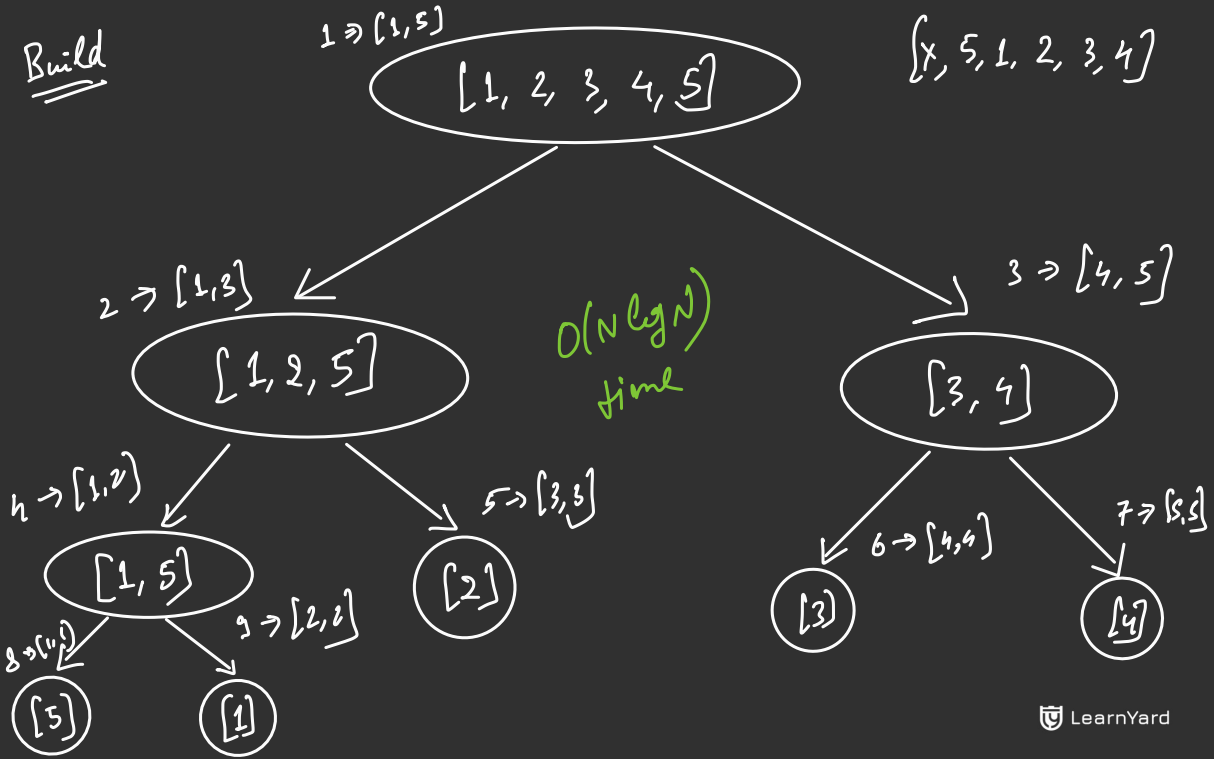
(l, r)

$$\sum_{i=l}^{r} B[i]$$

⇓

Prefix Sum

Intuition / Solution


Build
1 ⇒ [1,5]
[1, 2, 3, 4, 5]
[x, 5, 1, 2, 3, 4]
2 ⇒ [1,3]
[1, 2, 5]
O(N lgN) time
3 ⇒ [4, 5]
[3, 4]
4 ⇒ [1,2]
[1, 5]
5 ⇒ [3,3]
[2]
8 ⇒ [1,1]
9 ⇒ [2,2]
[5]
[1]
6 ⇒ [4,4]
7 ⇒ [5,5]
[3]
[4]
LearnYard

Segment Tree (Merge Sort Tree)

+

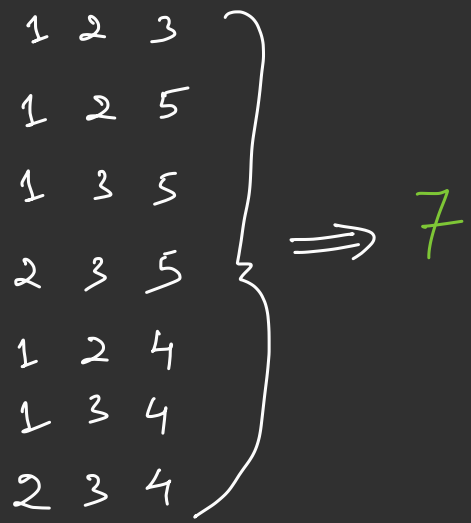
Binary Search

Let’s implement

2. Subsequences

N = 5, K = 3

[1, 2, 3, 5, 4]

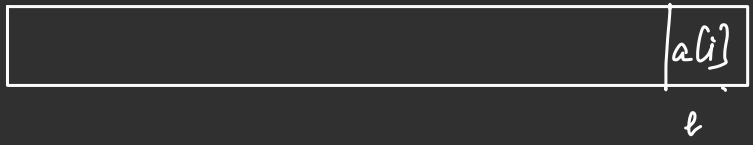


Intuition / Solution

$dp[i][l]$ → No. of increasing subsequences of length l s.t. the last element is $a[i]$

ans ⇒ $dp[1][k] + dp[2][k] \cdots\cdots + dp[n][k]$

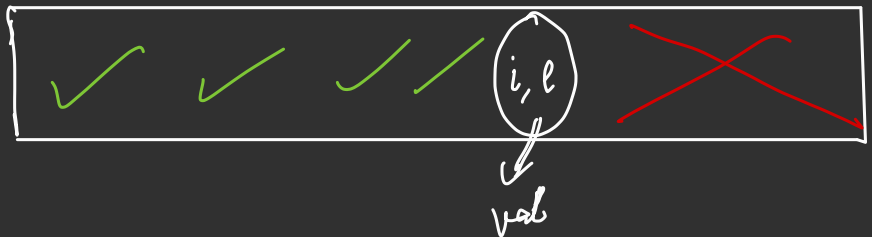
$dp[i][1] \Rightarrow 1$ (Base Case)



$dp[i][l] = 0$

iterate over all j s.t $j < i$ && $a[j] < a[i]$:

$dp[i][l] += dp[j][l-1]$



From the left, I need sum of dp[j][l-1] values for all such indices j s.t. a[j] < val.

$N = 5, \quad K = 3$

$[1, 4, 2, 3, 5]$

$i = 4$

$l = 3$

	1	2	3	4	5
$l=1$	1	1	1	1	1
$l=2$	0	1	2	1	4
$l=3$	0	0	1	0	4

length l

last elem $\Rightarrow$ val

$$\sum_{v_2 < val \;\&\; ind[v_2] < ind[val]} dp[v_2][l-1]$$

Let's implement

[DP + Fenwick Tree]

Time $\Rightarrow O(N * K * \log N)$

Thank You!

Reminder: Going to the gym & observing the trainer work out can help you know the right technique, but you'll muscle up only if you lift some weights yourself.

So, PRACTICE, PRACTICE, PRACTICE!