Class 01 - Introduction

Sunday, February 28, 2021 9:54 PM

Segment Tree

↳ Data Structure

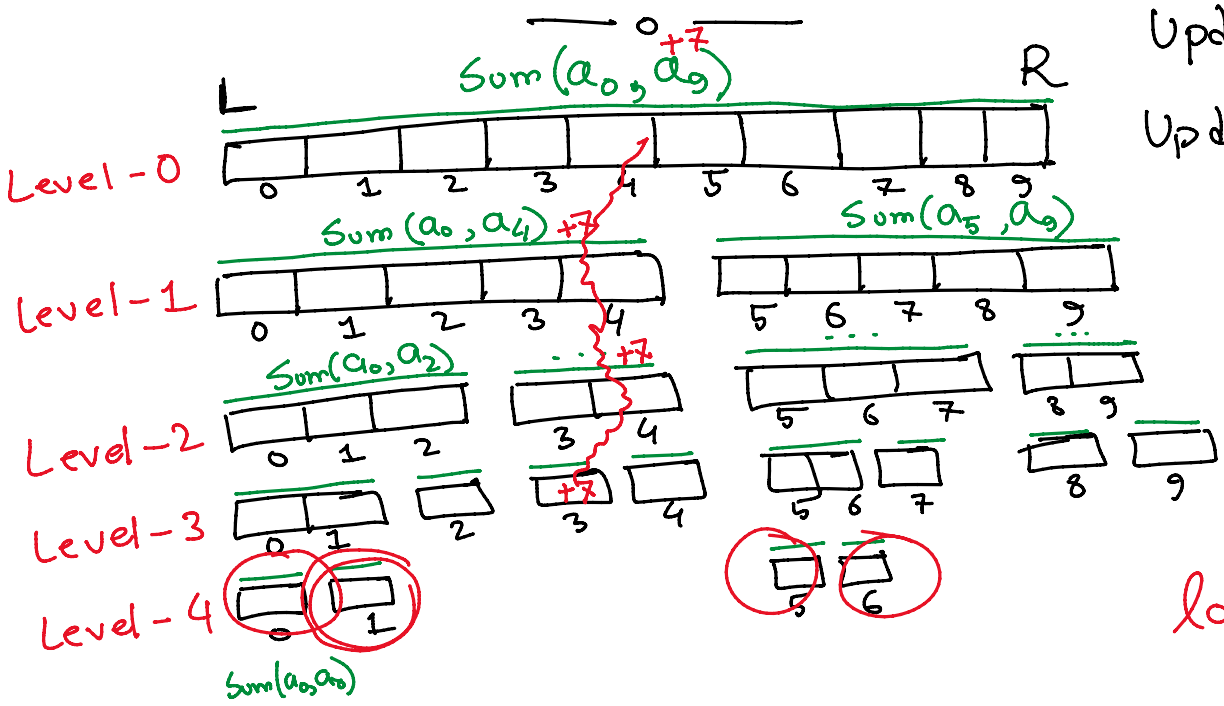
↳ Yet, powerful !

T : 2sec

P1: N - size array $(1 \le N \le 10^5)$ $(-10^9 \le v \le 10^9)$

O(1) O(N) ↳ Update: x v

O(N) O(1) ↳ Query: Sum(L, R) $(1 \le Q \le 10^5)$



Update a_3 7

Update N x

$\log_2(10) = 4$

L-0 → $N = N/2^0$

L-1 → $N/2 = N/2^1$

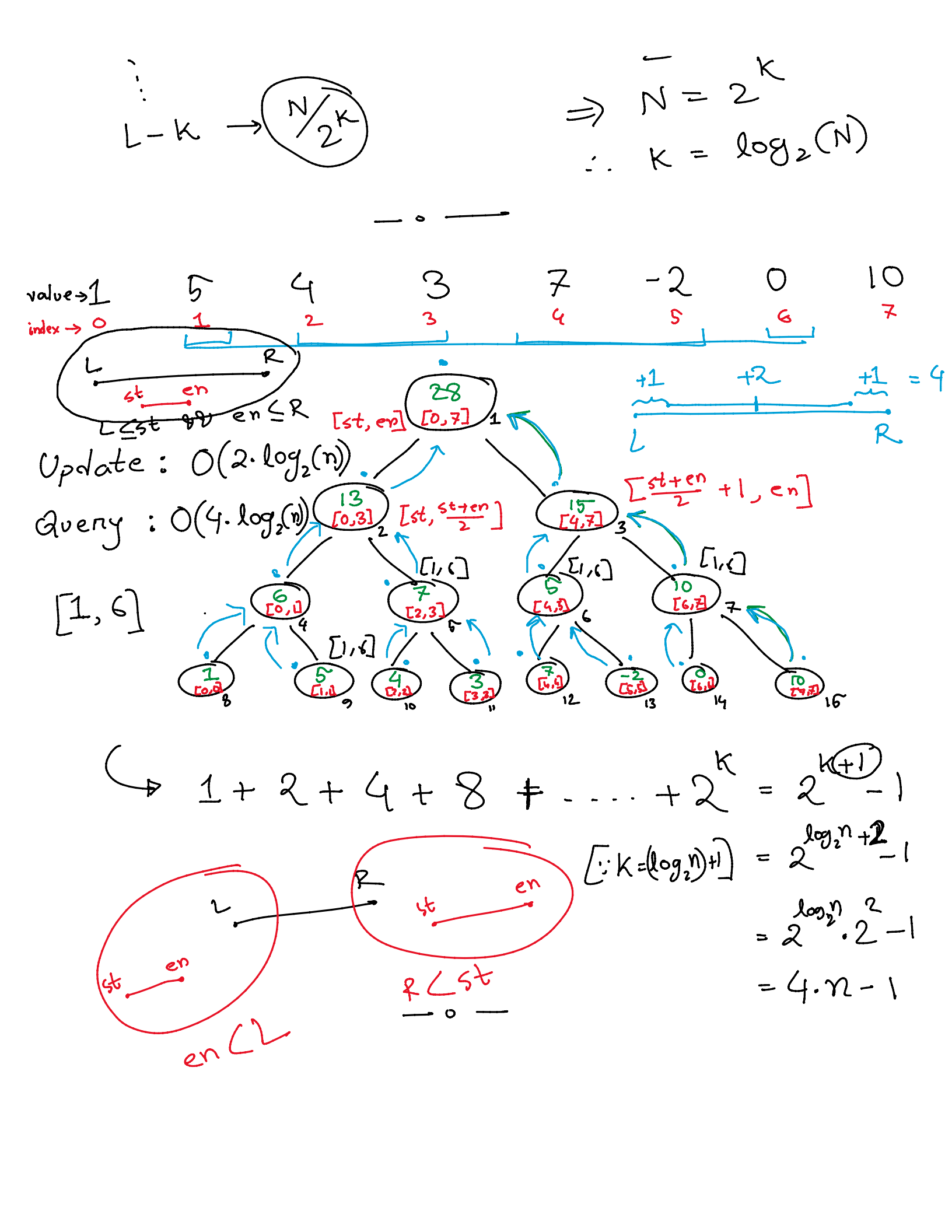
L-2 → $N/4 = N/2^2$

⋮

N/..

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

→ $N = 2^k$


L - k → N/2^k
⇒ N = 2^k
∴ k = log2(N)
value→ 1 5 4 3 7 -2 0 10
index→ 0 1 2 3 4 5 6 7
L R
st en
L ≤ st && en ≤ R
[st, en]
28 [0,7] 1
+1 +2 +1 = 4
L R
Update : O(2·log2(n))
Query : O(4·log2(n))
[1, 6]
13 [0,3] 2
[st, st+en/2]
15 [4,7] 3
[st+en/2 + 1, en]
6 [0,1] 4
7 [2,3] 5
5 [4,5] 6
10 [6,7] 7
[1,6]
1 [0,0] 8
5 [1,1] 9
4 [2,2] 10
3 [3,3] 11
7 [6,6] 12
-2 [5,5] 13
0 [6,6] 14
10 [7,7] 15
↳ 1 + 2 + 4 + 8 + ... + 2^k = 2^(k+1) - 1
[∵ k = (log2 n) + 1] = 2^(log2 n + 2) - 1
= 2^(log2 n) · 2^2 - 1
= 4·n - 1
L R st en
en < L
R < st