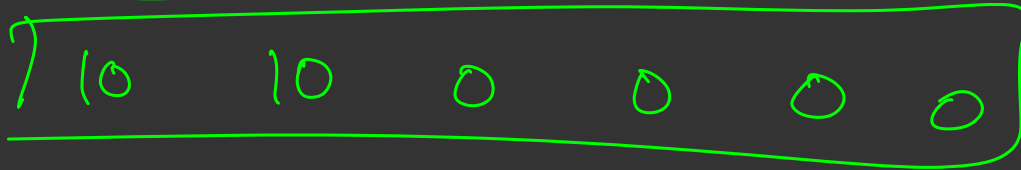
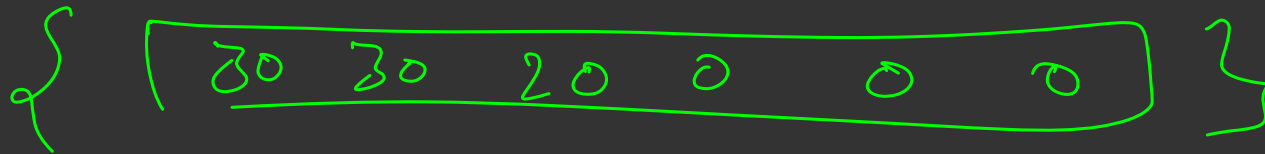


Q1  $\rightarrow$  0 — 1      Add 10  
      L     R



Q2  $\rightarrow$  0 — 2      Add 20





Brute force

→ for every query go from  $L$  to  
 $R$  and add  $X$   $O(n)$

$O(Q \cdot N)$

0 0 0 0 0 0 0 0

$Q_1 \rightarrow (0, 2) \text{ add } 1$

$L \rightarrow \text{add } X$

$R+1 \rightarrow \text{subtract } X$

$\rightarrow$  1 0 0 -1 0 0 0 0

$Q_2 \rightarrow (0, 3) \text{ add } 2$

$L \rightarrow \text{add } X$

$\rightarrow$  3 0 0 -1 -2 0 0 0



→ 3 3 3 2 0 0 0

## Difference Array

~~Q~~  $N \rightarrow \text{left}$   $Q \rightarrow \text{left}$   
 $\hookrightarrow O(N)$   $\hookrightarrow \underline{O(Q)}$   
add  $x$  to  $L$   
subtract  $x$  from  $R+1$   $O(1)$   $\hookrightarrow \underline{O(N)}$

Prefix Sums  $\rightarrow$  No updates, only sum queries  
 $O(Q+N)$

Difference Array  $\rightarrow$  All updates come before the range queries  $O(Q+N)$

Segment Tree

$\hookrightarrow$  update and range queries interleaved

