Difference Array

Concepts & Qns

(M)otivation :- Make this year to transform dreams into reality! Work hard to build the future YOU DESERVE.

Stay focused, stay relentless and let success be your STORY

MIK...

(5th Jan, 2025)

2381. Shifting Letters II

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Medium | Topics | Companies | Hint

You are given a string `s` of lowercase English letters and a 2D integer array `shifts` where `shifts[i] = [start_i, end_i, direction_i]`. For every `i`, **shift** the characters in `s` from the index `start_i` to the index `end_i` (**inclusive**) forward if `direction_i = 1`, or shift the characters backward if `direction_i = 0`.

Shifting a character **forward** means replacing it with the **next** letter in the alphabet (wrapping around so that `'z'` becomes `'a'`). Similarly, shifting a character **backward** means replacing it with the **previous** letter in the alphabet (wrapping around so that `'a'` becomes `'z'`).

Return *the final string after all such shifts to* `s` *are applied.*

Example :- s = "abc"

shifts = [(0,1,0), (1,2,1), (0,2,1)]

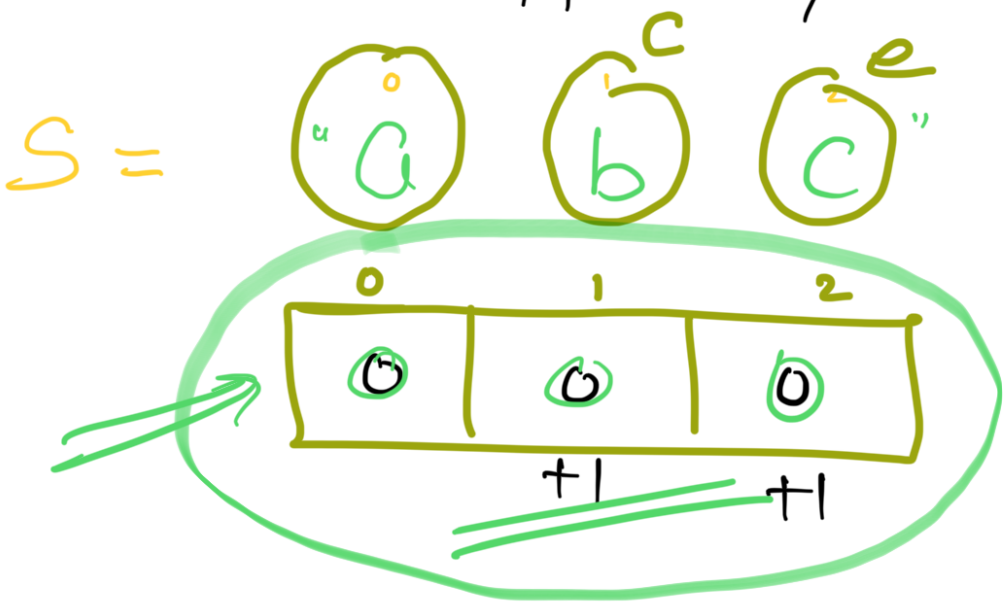
Output :- "ace"

T.C = O(Q * n) T.L.E.

Thought Process

s = "abc"

shifts = [(0,1,0), (1,2,1), (0,2,1)]

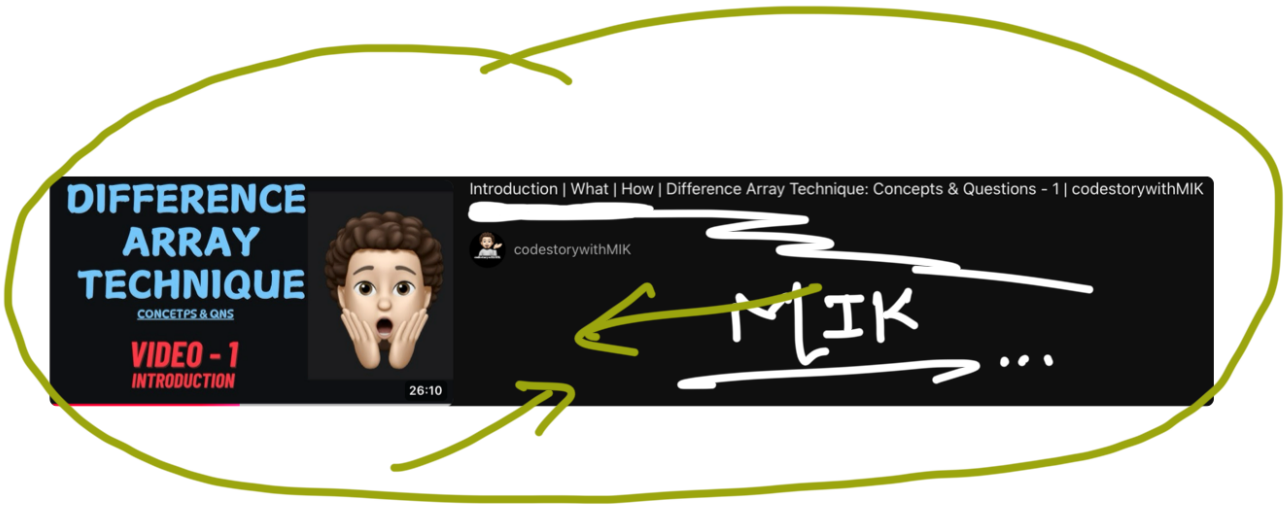


Range → Addition

dix: 0 (-1)

dix: 1 (+1)

Difference Array



① Find diff array

Query = [L, R, x]

0 → -1

1 → +1

diff[L] += x

diff[R+1] -= x → (Add safety check)

② Cumulative Sum of diff array.

↳ It helps to find resultant change/shift in each index.

S = "a b c"

0 1 2

Queries = [(0,1,0), (1,2,1), (0,2,1)]

L = 0
R = 2
x = 1

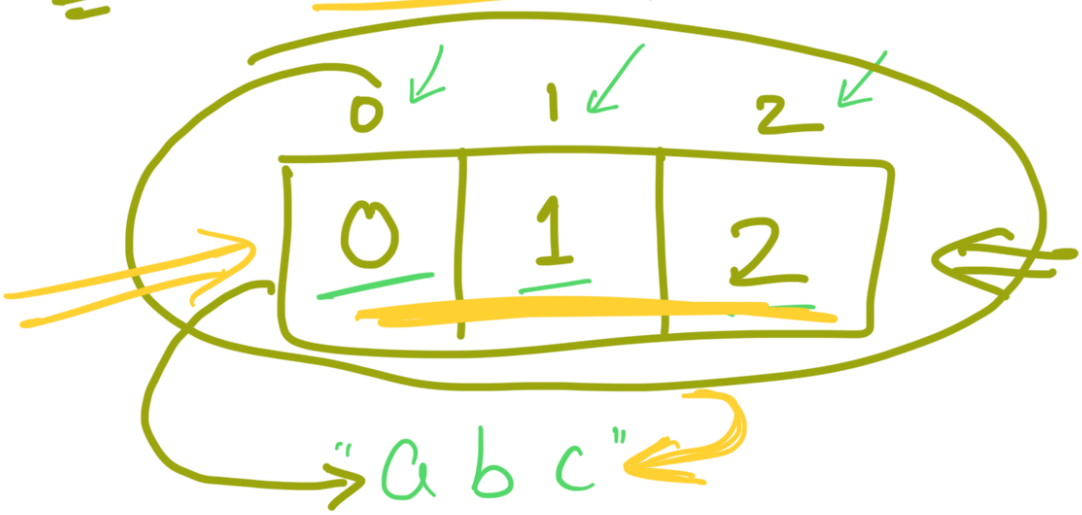
diff =

0	1	2
0	1	1

diff[L] += x

diff[R+1] -= x → if(R+1 < n)

Step-2. Cumulative Sum.



a → 0 ⟶ 'a' − 'a' = 0

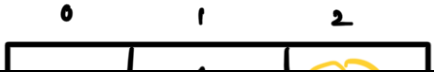
b → 1 ⟶ 'b' − 'a' = 1

c → 2 ⟶ 'c' − 'a' = 2

⋮

① (S[i] − 'a') = value

② value + 'a' = S[i] //character.



S[i] − 'a' =

s "a b c"

a c e

'c' - 'a' = 2

2 + diff[i] = 4

4 + 'a' = 'e'

a b c d e

$$S[i] = \{ (S[i] - 'a') + diff[i] \} + 'a' ;$$

(S[i] - 'a') : char val.

diff[i] : shift

Corner Case:-

① wrap around = (28 % 26) = 2

② +26