

SLIDING

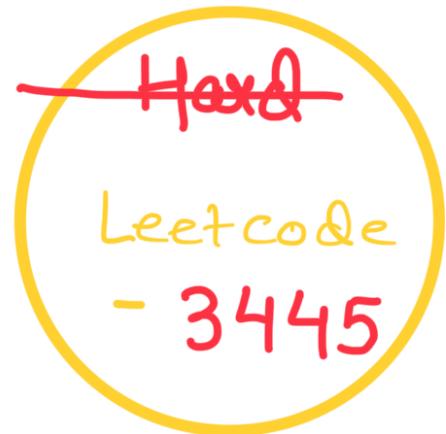
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WINDOW

MECHANISM...

Export



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Weekend WITH MIK

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Welcome to WeekendWithMIK 🎉✨ >



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+
Tech News

Motivation :-

If you feel exhausted, take a break.

Just like a machine needs servicing,

we need rest periodically.

Freshen up and then come back

stronger.



MIK...

3445. Maximum Difference Between Even and Odd Frequency II

Hard

Topics

Companies

Hint

You are given a string s and an integer k . Your task is to find the maximum difference between the frequency of two characters $\text{freq}_{\text{a1}} - \text{freq}_{\text{b1}}$ in a substring sub_i of s such that:

frequency of two characters, $\text{freq}[a]$ and $\text{freq}[b]$, in a substring subs of S , such that

- subs has a size of **at least k** .
- Character a has an **odd frequency** in subs .
- Character b has an **even frequency** in subs .

Return the **maximum** difference.

Note that subs can contain more than 2 **distinct** characters.

Example :- $S = "1 \underline{2} 2 3 3"$, $K = 4$

Output = -1

$$\begin{aligned} b &= 2 \rightarrow 2 \\ a &= 1 \rightarrow 1 \end{aligned}$$

$S = "1122211"$, $K = 3$

Output = 1

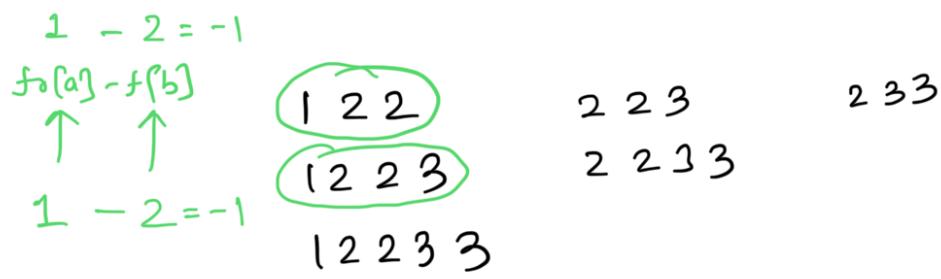
$S = "110"$, $K = 3$

Output = -1

Thought Process
go on

Brute Force

$S = "12233"$, $K=3$



Optimal Approach

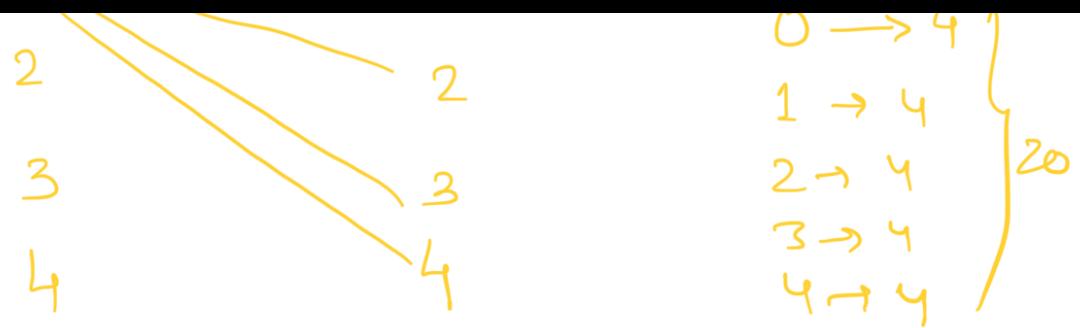
Constraints $\rightarrow S$ only contains '0' to '4'



$$freq[a] - freq[b] \rightarrow \text{maximize}$$

\downarrow
Odd Even



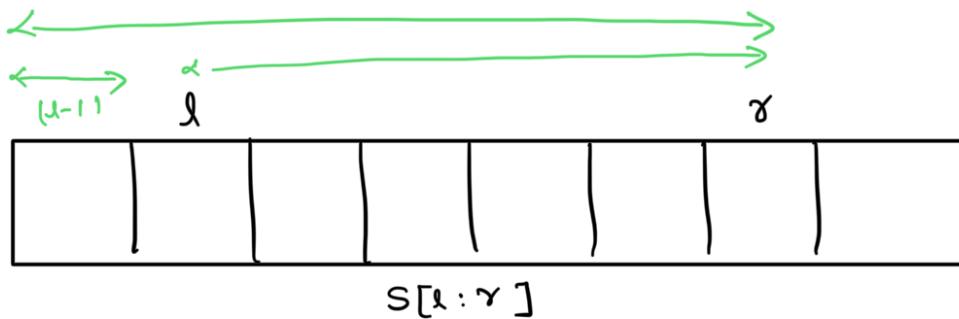


```
{
    for( a = '0' ; a<='4' ; a++) {
        for ( b = '0' ; b<='4' ; b++) {
            // a, b
            result = freq[a] - freq[b]
        }
    }
    return result;
}
```

$a, b \rightarrow \text{best } freq(a) - freq(b)$

what do we have ?

- Sliding window*
- i) a , b
 - ii) S string input
 - iii) K substring size ($\geq K$)



$$\text{freq}[a] = (\text{count of } a \text{ till } r) - (\text{count of } a \text{ till } l-1);$$

$$\text{freq}[b] = (\text{count of } b \text{ till } r) - (\text{count of } b \text{ till } l-1);$$

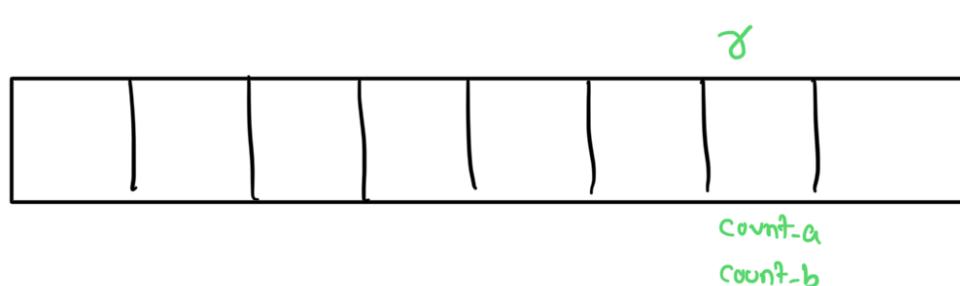
$$\text{freq}[a] - \text{freq}[b] = \left\{ \text{Count}[a:r] - \text{Count}[a:l-1] \right\} -$$

$$\left\{ \text{Count}[b:r] - \text{Count}[b:l-1] \right\}$$

$$\text{freq}[a] - \text{freq}[b] = \boxed{\left\{ \text{Count}[a:r] - \text{Count}[b:r] \right\}} - \boxed{\left\{ \text{Count}[a:l-1] - \text{Count}[b:l-1] \right\}}$$

(count-a - count-b)

(Pre-count-a - Pre-count-b)





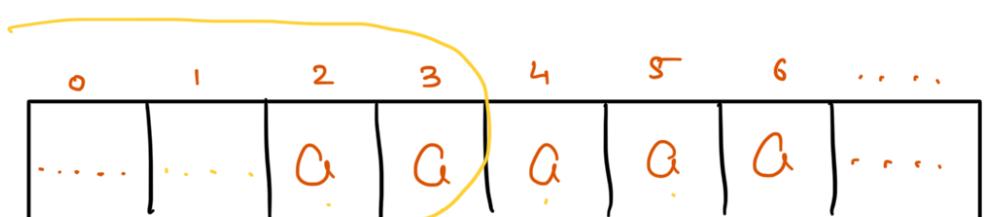
For a given index τ , we have to find the best index $(l-1)$ where $(\text{Count of } a - \text{Count of } b)$ was minimum.

"a odd count
b even count"

Handling odd/even count

q a/b

$a = 1$



$\rightarrow \tau$
 \downarrow
 $\text{count-a} = 5 \quad (\text{odd})$

at γ , count-a even \rightarrow choose to remove odd a from left

at γ , count-a odd \rightarrow choose to remove even a from left.

$$\begin{array}{l} \cancel{\star} \\ \text{'a'} \end{array} \left\{ \begin{array}{l} \text{even - odd = odd} \\ \text{odd - even = odd} \end{array} \right.$$

0	1	2	3	4	5	6	...
.....	b	b	b	b	b

↑
 γ

count-b = 5 (odd)

$\cancel{\star}$ if at index γ , we have even count of b,
remove even count of b from left.

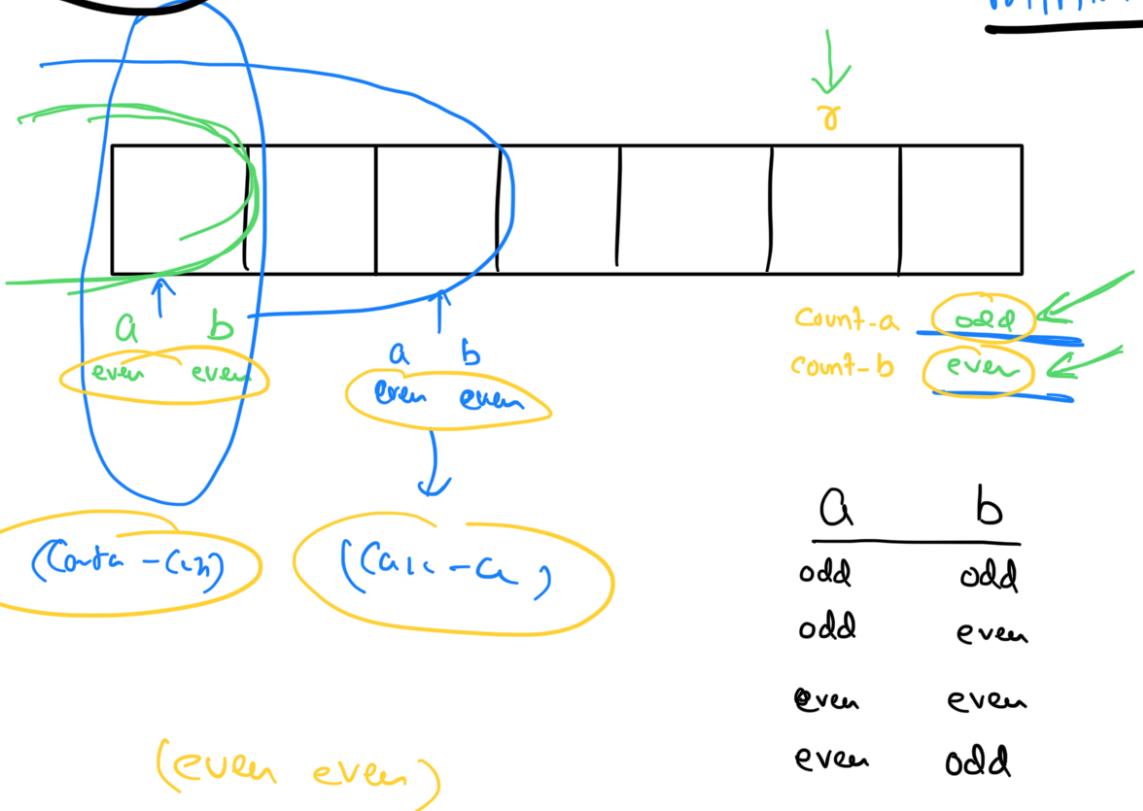
\star if at index γ , we have odd count of b,
remove even count of b from left.

$$\begin{array}{l} \star \\ \text{'b'} \end{array} \left\{ \begin{array}{l} \text{even - even} \\ \text{odd - even} \end{array} \right. \begin{array}{l} = \text{even} \\ = \text{even} \end{array}$$

$\text{freq}[a] - \text{freq}[b] =$

$$\left\{ \text{count}[a:\gamma] - \text{count}[b:\gamma] \right\} - \left\{ \text{count}[a:\underline{l-1}] - \text{count}[b:\underline{l-1}] \right\}$$

minimal



How to achieve this in Best Possible way ???





$$\text{Count-a} = 3 \div 2 = 1 \quad (\text{odd})$$

$$\text{Count-b} = 2 \div 2 = 0 \quad (\text{even})$$

a	b	Decimal	a	b
1	0	= R	odd	odd
0	1	= 1	odd	even
1	1	= 3	even	even
0	0	= 0	even	odd

7th index

a b
0 1

Maths:

xor 10

left side

11

1 0

xor 10

0 0

1 1

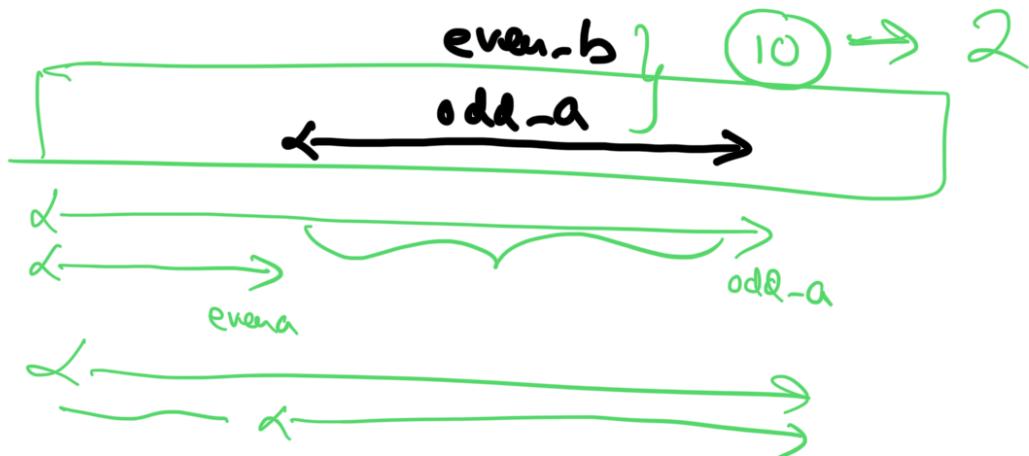
xor 10

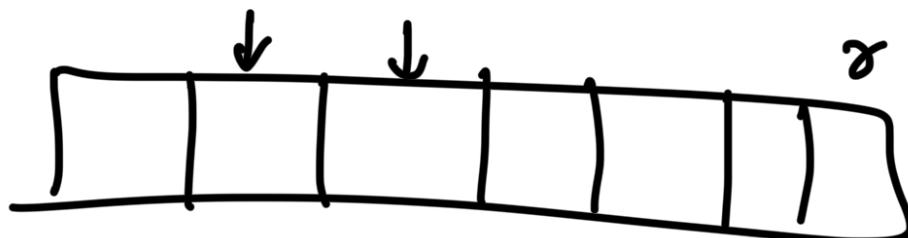
0 1

1 0

xor 10

0 0





* ee

At dex γ , find the state

*

state $\text{XOR } \begin{smallmatrix} 2 \\ (10) \end{smallmatrix}$ = leftHandSideState

* leftHandState \rightarrow Choose the one having minimum diff (counta - countb)

$\rightarrow \begin{smallmatrix} (00) \\ 0 \end{smallmatrix} \quad \begin{smallmatrix} (01) \\ 1 \end{smallmatrix} \quad \begin{smallmatrix} (10) \\ 2 \end{smallmatrix} \quad \begin{smallmatrix} (11) \\ 3 \end{smallmatrix}$

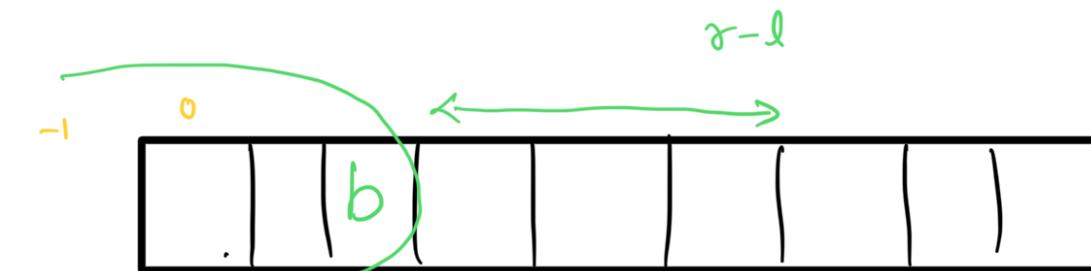
State Prev-a-b \Rightarrow



Stores minimum value of (counta - countb)

Let's do the Sliding

window now



$$\begin{cases} \text{Pre-a} / 2 \\ \text{Pre-b} / 2 \end{cases}$$

state = 01

$$x = R_{\text{count-a}} - R_{\text{count-b}}$$

$$\begin{cases} \text{count-a} \\ \text{count-b} \end{cases}$$



State $\text{Prev-a-b} \Rightarrow$



Stores minimum value of $(\text{count-a} - \text{count-b})$

$$st = \min(\infty, x);$$

while($r-l \geq k$) {

}

