

ABA B

Naive: for each i , go as right as possible
until k is used up

A B A B

↑

2

↑

8

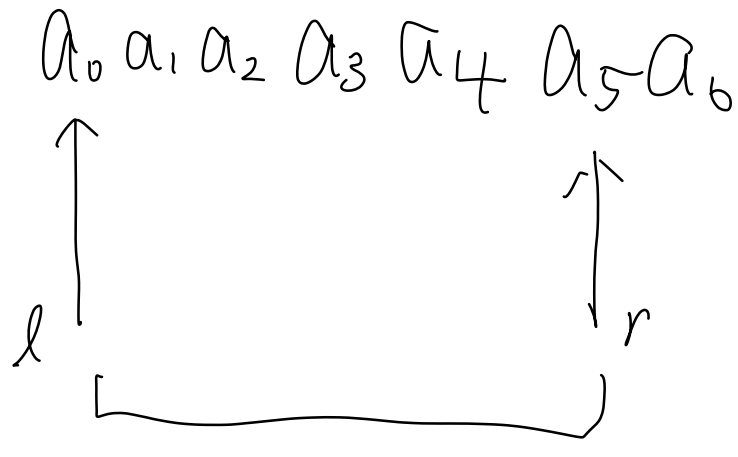
Search A, B, C ... 2 separately

$$\begin{array}{cccccc} a_0 & a_1 & a_2 & a_3 & a_5 \\ \uparrow & & & & \uparrow \\ l & & & & r \end{array}$$

$[l, r)$ is the longest
starting from l

When we move l by 1,
we know that it has at least
 $[l+1, r)$ is a valid one!

Directly apply a sliding window



record a $\text{freq}[26]$

if in $[l, r]$, $\max(\text{freq}) + k > r - l + 1$

\Rightarrow we can keep go right

if $[l, r)$ is the longest one,
we will need to move l right

Let say $\text{max_count} = \text{max}(\text{freq})$

We will find out that when we move l to the right, we don't know how to update max_count to reflect the true $\text{max}(\text{freq})$ within a window.

However, does it really matter that max_count reflects $\text{max}(\text{freq})$?

$a_0 a_1 a_2 a_3 a_4 a_5 a_6$



Suppose: $k=3$
AA A BCDE F



max_count = 3 (\because # of A)

A A A B C D E F

↑
 l'

↑
 r

if we don't update `max-count`,

$[l', r]$ at most can be expanded

to `max-count + k`

Observe that if `max-count` reflects

the wrong `max(freq)`, the window

length will not exceed `max-count + k`

⇒ not affect our answer!

Claim: Suppose $[l, r]$ is the optimal solution

and $\max(\text{freq}, [l, r]) = \text{true_maxcount}$

and $k \geq 0$ is the # operations we allow to do

Case 1: $r - l + 1 = \text{true_maxcount} + k$

Case 2: $r - l + 1 < \text{true_maxcount} + k$

For Case 1:

when we expand using a fake max count which does not reflect $\max(\text{freq}, \text{window})$,

it is ok because $\text{fake_maxcount} < \text{true_maxcount}$

The window created by fake maxcount
will not exceed true-maxcount + k

For case 2:

$$r - l + 1 = \text{len}(s)$$

because if $r - l + 1 < \text{len}(s)$

$a_0 a_1 a_2 a_3 a_4 a_5$

\uparrow \uparrow
 l r

$$\text{true maxcount} = \max(\text{freq}_1[l, r])$$

we still have operations to use

\Rightarrow keep expanding

\Rightarrow contradicts that this is
the optimal solution