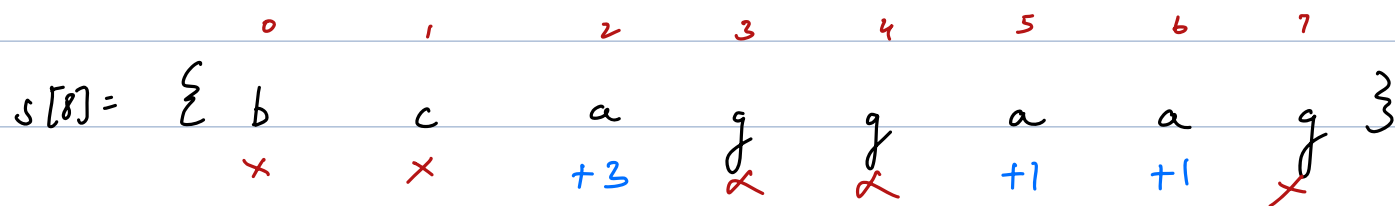
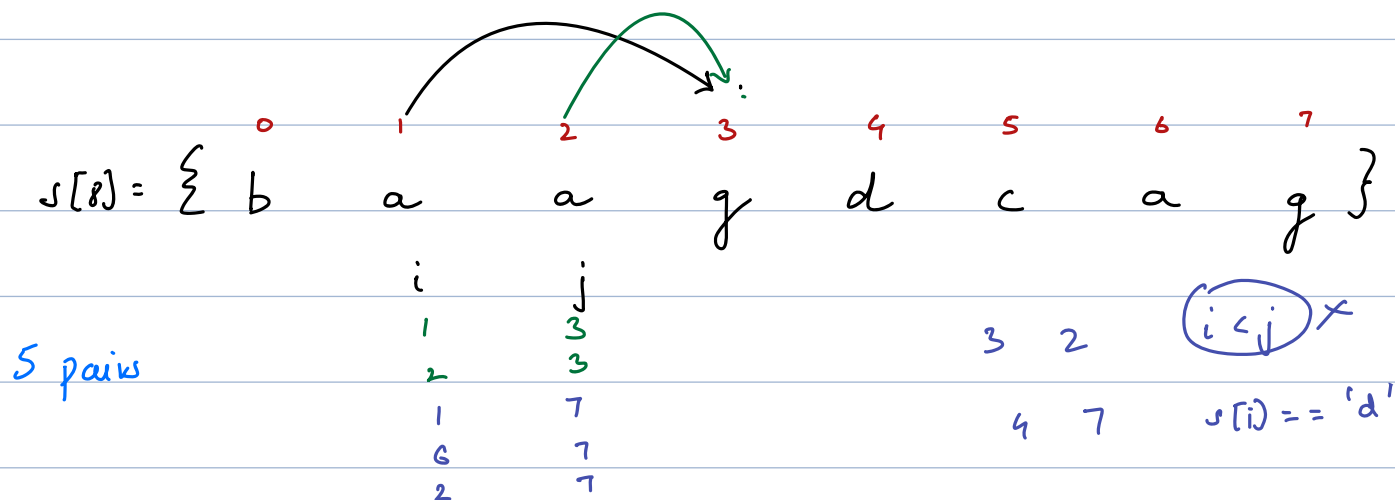
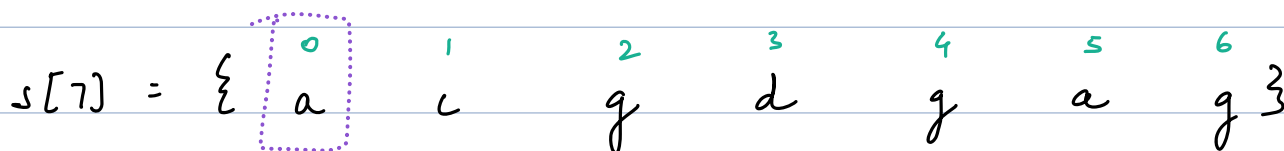


Q1) Given a char [], calculate no. of pairs (i, j) such that $i < j$ & $s[i] = 'a'$ & $s[j] = 'g'$.



Ans: 5



Ans: 5

$i < j$ $s[i] = 'a'$ $s[j] = 'g'$

	0	1	2	3	4	5	6	7	
{	a	c	g	a	d	g	a	g	}
	+3			+2			+1		

Ans: 6

count = 0

TC: $O(N^2)$

```

for (i = 0; i < N; i++) {
    if (s[i] == 'a') {
        for (j = i + 1; j < N; j++) {
            if (s[j] == 'g') {
                count++
            }
        }
    }
}

return count

```

Problem: For every a, we are repeatedly
 iterating the same array from L-R
 to count total no. of gs

No. of gs on the right of every a

	0	1	2	3	4	5	6	7	
$s[8] = \{$	b	c	a	g	g	a	a	g	$\}$
			agc += cg	cg++	cg++	agc += cg	agc	cg++	
			agc = 5	cg = 3	cg = 2	cg	+ = cg	cg = 1	
						cg = 2	agc = 1		

cg = 0 ag count = 0

ans = 0

agc → 5

cg = 0

	0	1	2	3	4	5	6	7
{	a	c	g	a	d	g	a	g }
	ans += cg		cg++	ans += cg		cg++	ans = ans + cg	cg++
	ans = 3 + 3		cg = 3	ans = 3		cg = 2	ans = 1	cg = 1
	ans = 6							

```

cg = 0      ans = 0
for (i = N-1; i >= 0; i--) {
    if (s[i] == 'g') {
        cg++
        if (s[i] == 'a') {
            ans += cg
        }
    }
}

```

TC: $O(N)$

SC: $O(1)$

return ans

count a = 0

ans = 0

{	⁰ a		¹ c		² g		³ a		⁴ d		⁵ g		⁶ a		⁷ g }
	cat++				ans += ca		cat++				ans += ca		cat++		ans += ca
	ca = 1				ans = 1		ca = 2				ans = 3		ca = 3		ca = 6

Q₂) Leaders in an Array

Given an array, you need to find leaders in $A[]$

An element is a leader if it is strictly greater than all elements on its right.

$A[N-1]$ is always a leader

$A[8] = \{ \overset{0}{3}, \overset{1}{2}, \overset{2}{4}, \overset{3}{5}, \overset{4}{2}, \overset{5}{1}, \overset{6}{3}, \overset{7}{0} \}$

α \checkmark \checkmark \checkmark α α \checkmark \checkmark

Ans: 3

α \checkmark \checkmark α α α \checkmark \checkmark

7 6 5 5 5 5 2 \checkmark

↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑

0 1 2 3 4 5 6 7

$A[8] = \{ 5, 7, 6, 1, -1, 0, 5, 2 \}$

α \checkmark \checkmark α α α \checkmark \checkmark

Ans: 4

If an element is greater than max of all elements on its right then it is a leader

```
for (i=0; i<N; i++) {
```

```
    # find the max on right
```

TC: $O(N^2)$

```
    # [i+1, N-1] → maxr
```

SC: $O(1)$

```
    if (A[i] > maxr) {
```

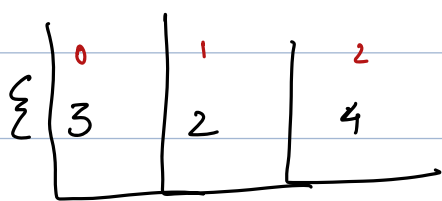
```
        leader++
```

```
    }
```

```
return leader
```

leaders = 3

max = 0



```
if (5 > max)
```

```
    leader++
```

```
    max = 5
```

```
if (3 > max) {
```

```
    leader++
```

```
    max = 3
```

leaders = 1

max = A[N-1]

TC: $O(N)$

```
for (i=N-2; i>=0; i--) {
```

SC: $O(1)$

```
    if (A[i] > max) {
```

```
        leader++
```

```
        max = A[i]
```

```
    }
```

```
return leader
```

	0	1	2	3	4	5	6	7
$A[i] = \{$	7	7	6	1	-1	0	5	9
$m = -\infty$	7	7	7	7	7	7	7	9

Max in array

$min = \infty$

Intege. min vcln

inf

INT-MIN

$curmax = -\infty$

```

for (i=0; i<N; i++) {
    if (A[i] > curmax) {
        curmax = A[i]
    }
}

```

$curmax = -\infty$

```

for (i=0; i<N; i++) {
    curmax = max(curmax, A[i])
}

```

Back (10:32 - 10:42)

Subarrays continuous part of array

→ Can single element be a subarray? Yes

→ Can entire array be a subarray? Yes

→ Can 0 elements be a subarray? No

$\{ 2 \quad 3 \quad 5 \quad 7 \quad 1 \quad 0 \quad -3 \}$

$\{ 3 \}$ ✓

$\{ 2 \quad 3 \quad 5 \quad 7 \quad 1 \quad 0 \quad -3 \}$ ✓

$\{ 3 \quad 5 \quad 7 \quad 1 \}$ ✓

$\{ 2 \quad 5 \quad 7 \}$ ✗

Closest Min Max

Amazon

Given an array find the length of smallest subarray which contains both min and max of array

Min: 1

Max: 6

0	1	2	3	4	5	6	7	8	9
[1	2	3	1	3	4	6	4	6	3]

Ans

Ans: 4

Min: 1

Max: 6

0	1	2	3	4	5	6	7	8	9	10
2	2	6	4	5	1	5	2	6	4	1

Ans: 3

Obs 1) In the min len subarray, min ele & max ele will be at corners

subl

sub 2


$$\underbrace{[\min \dots \max]}_L$$
$$\underbrace{[\min \dots \max \dots]}_L$$

① ✓✓

② ✓

$\{1, 2, 3, 5\}$

Min Max

A horizontal line with a double underline connects the 'Min' label on the left to the 'Max' label on the right. Above this line, the set {1, 2, 3, 5} is written in red.

$\{ 1 \quad 2 \quad 3 \quad 5 \quad 4 \quad 2 \quad 3 \}$

$\uparrow \qquad \qquad \qquad \uparrow$

$\text{min} \qquad \qquad \qquad \text{max}$

$$\{1, 2, 3, 5, 4, 2, 3\}$$

2)

[Min Max]

[Max Min]

1) Find Min, Max

min = 1, max = 6

0	1	2	3	4	5	6	7	8	9	10
2	2	6	4	5	1	5	2	6	4	1
↑	.	✓	✗	✗			4			
✗	✗									

$[2, 5] = 5 - 2 + 1$
 $= 4$

-5

Max \longrightarrow Min

minlen = 4

Min \longrightarrow Max

TODO:

i) Find and max

TC: $O(N^2)$

minlen = $+\infty$

SC: $O(1)$

iterate over all the elements

\rightarrow if it is not min or max

skip

\rightarrow if it is max

$l = i$

look for min index on right $[i+1, N-1] \rightarrow r$

$len = r - l + 1$

$minlen = \min(minlen, len)$

\rightarrow if it is min

$l = i$

look for max index on right $[i+1, N-1] \rightarrow r$

$len = r - l + 1$

$$\text{minlen} = \min(\text{minlen}, \text{len})$$

1) Min, Max values $\rightarrow O(N)$

2) $\text{mini} = -1$ $\text{maxi} = -1$

3) $\text{minlen} = \infty / N$

Min \rightarrow max on right

Max \rightarrow min on right

$\text{max} = 6$ $\text{min} = 1$

0	1	2	3	4	5	6	7	8	9	10	11
1	6	4	5	1	5	2	6	4	2	1	5
$\text{mini} = 0$							$\text{maxi} = 7$			$\text{mini} = 10$	
$\text{len} = 2$	$\text{maxi} = 1$			$\text{mini} = 4$			$\text{len} = 10 - 7 + 1$				
$\text{maxlen} = 2$	$\text{len} = 4$			$\text{len} = 4$			$= 4$				
	$\text{minlen} = 4$			$\text{minlen} = 4$			$\text{minlen} = 4$				

[2 , 2 , 2 , | 2]

min = 1

max = 6

max i = -1

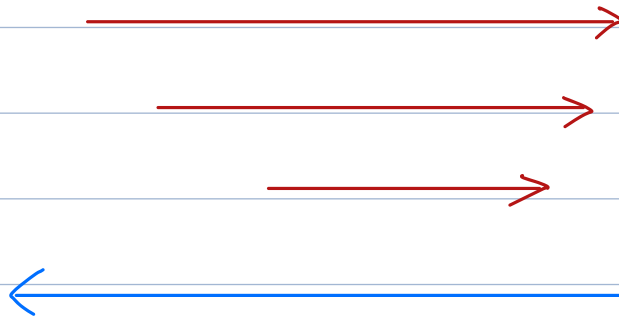
mini = -1

minlen = ∞/N

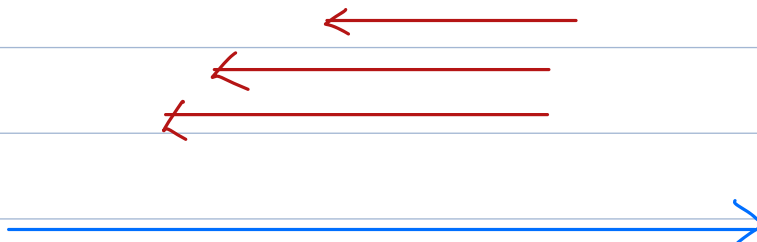
0	1	2	3	4	5	6	7	8	9	10
2	2	6	4	5	1	5	2	6	4	1
		maxi = 2		mini = 5		maxi = 8		mini = 10		
len = 4				len = 4		len = 10 - 8 + 1				

= 3

minlen = 3



$r - l + 1$
 \uparrow
 $r > l$



$maxi = -1$, $mini = -1$, $minlen = \infty$

1) $min-v$ $max-v$

for ($i = n-1$; $i \geq 0$; $i--$) {

if ($A[i] == max$) {

$maxi = i$

if ($mini \neq -1$) {

$len = max(mini, maxi) - min(maxi, mini) + 1$

$minlen = min(minlen, len)$

if ($A[i] == min$) {

$mini = i$

if ($maxi \neq -1$) {

$len = max(mini, maxi) - min(maxi, mini) + 1$

$minlen = min(minlen, len)$

return $minlen$

$r > l$

$$1 \leq N \leq \underline{10^6}$$

$$10^4 \leq N \leq 10^6$$

Second.