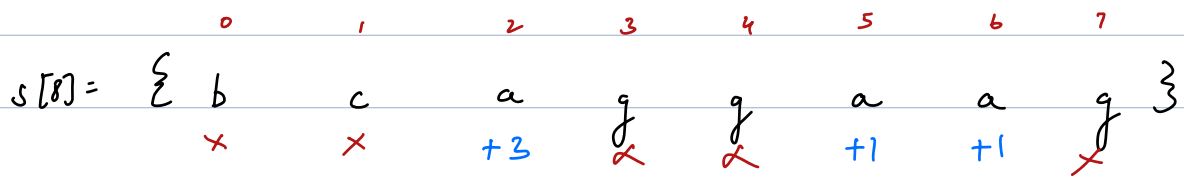
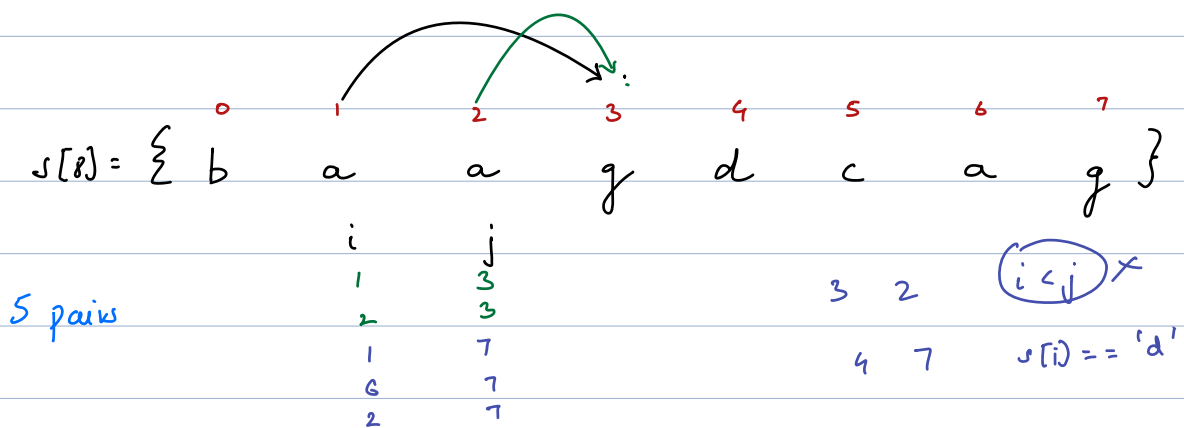
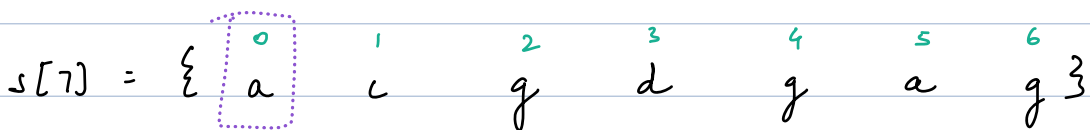


Q1) Given a char [], calculate no. of pairs (i,j) such that $i < j$ & & $s[i] = 'a'$ & & $s[j] = 'g'$.



Ans: 5



Ans: 4

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

	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
b	c	a	g	g	a	a	g
		agc += cg	cg++	cg++	agc +=	agc	cg++
		agc = 5	cg = 3	cg = 2	cg	t = 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

TC: O(n)

for (i = N-1; i >= 0; i--) {

SC: O(1)

if (s[i] == 'g') {

cg++

if (s[i] == 'a') {

ans += cg

}

}

return ans

count a = 0

ans = 0

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

$A[8] = \begin{matrix} & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ \{ & 3 & 2 & 4 & 5 & 2 & 1 & 3 & 0 \} \\ & \times & \times & \times & \checkmark & \times & \times & \checkmark & \checkmark \end{matrix}$

Ans: 3

$A[6] = \begin{matrix} & \times & \checkmark & \checkmark & \times & \times & \checkmark & \\ 7 & 6 & 5 & 5 & 5 & 5 & 2 & \checkmark \\ \uparrow & \uparrow & \uparrow & \uparrow & \uparrow & \uparrow & \uparrow & \uparrow \\ 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ \{ & 5 & 7 & 6 & 1 & -1 & 0 & 5 & 2 \} \\ & \times & \checkmark & \checkmark & \times & \times & \times & \checkmark & \checkmark \end{matrix}$

Ans: 4

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

```

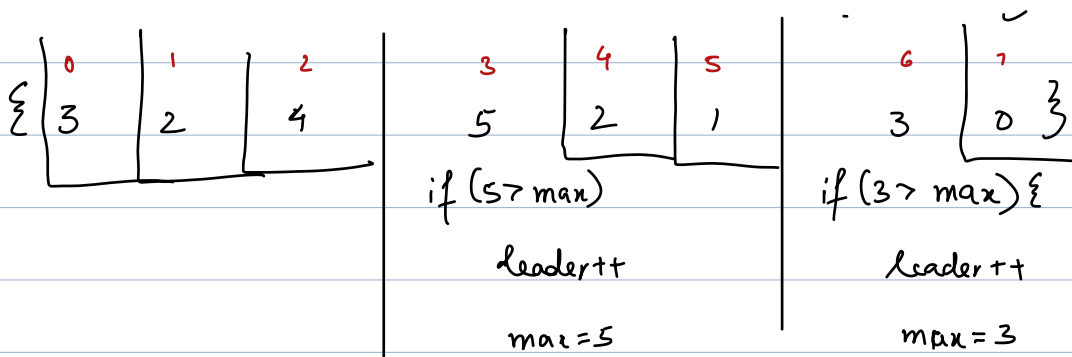
for (i=0; i<N; i++) {
    # find the max on right    TC: O(N^2)
    # [i+1, N-1] → maxr      SC: O(1)
    if (A[i] > maxr) {
        leader++
    }
}

return leader

```

leaders = 3

max = 0



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

$min = \infty$

Integer min value

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

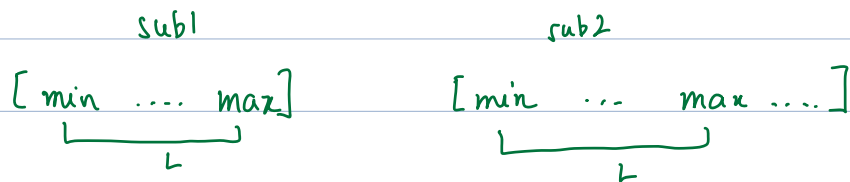
Min: 1

Max = 6

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

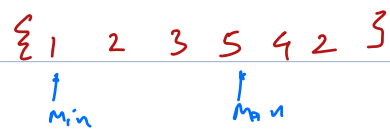
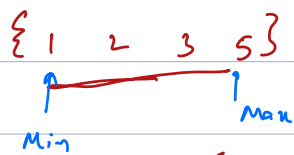
Ans: 3

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



① ✓

② ✓



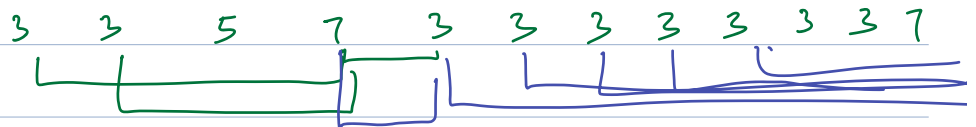
{ 1 2 3 5 4 2 3 }

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			
✗	✗									

len = 3

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

$$= 4$$

-5

Max → Min

minlen = 4

Min → Max

TODO:

i) Find and max

TC: $O(N^2)$

minlen = $+\infty$

SC: $O(1)$

iterate over all the elements

→ if it is not min or max
skip

→ if it is max

$l = i$

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

$$len = r - l + 1$$

$$minlen = \min(minlen, len)$$

→ 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

max = 6 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
mini = 0							maxi = 7			mini = 10	
len = 2	maxi = 1			mini = 4			len = 10 - 7 + 1				
maxlen = 2	len = 4			len = 4			= 4				
	minlen = 4			minlen = 4			minlen = 4				

[2, 2, 2, | 2]

min = 1

max = 6

maxi = -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

→

→

→

←

←

←

←

→

$r - l + 1$

↑

$r > l$

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

```
1) min-v      max-v
   if (maxv == minv) {
       return 1
   }
   for (i = n-1; i >= 0; i--) {
       if (A[i] == max) {
           maxi = i
           if (mini != -1) {
               len = max(mini, maxi) - min(maxi, mini) + 1
               minlen = min(minlen, len)
           }
       }
       if (A[i] == min) {
           mini = i
           if (maxi != -1) {
               len = max(mini, maxi) - min(maxi, mini) + 1
               minlen = min(minlen, len)
           }
       }
   }
   return minlen
```

$2 > 2$

✓

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

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

Second.