7 days.

Total ⇒ 168

Sleep ⇒ 49 (7×7)

Office ⇒ 50 (5× 10)

Nojimds ⇒ 21 (7× 3)

Fun ⇒ 21 (7×3)

Scaler class ⇒ 9 (3×3)

⇒ 150

Prac ⇒ 168 − 150 ⇒ $\boxed{18}$

Q1 Given an array of size N. Find the maximum value of $j-i$ such that $A[i] \leq A[j]$.

Constraints $1 \leq n \leq 10^5$ ⇒ TC possible ⇒ $O(n)$

$-10^9 \leq A[i] \leq 10^9$ $\qquad O(n \log n)$

$O(n\sqrt{n})$

$$\begin{array}{ccccc} & 0 & 1 & 2 & 3 \\ A = [& 3, & 5, & 4, & 2] \end{array}$$

Eg :

$j = 3$: no i available

$j = 2$: $i = 0$, ans ⇒ $2-0$ ⇒ 2

$j = 1$: $i = 0$, ans ⇒ $1-0$ ⇒ 1

$j = 0$: no j available

Brute Force : Check for every pair.

TC: $O(n^2)$.

SC: $O(1)$.

Hint 1:

(first , second)
↓ value ↓ index

0	1	2	3

A = [3, 5, 4, 2]

⇒

(3,0)
(5,1)
(4,2)
(2,3)

$\xrightarrow[\text{first term}]{\text{Sort on}}$

(2,3)
(3,0)
(4,2)
(5,1)

arr[i]

↓ arr[j]

0	1	2	3
3	0	0	0

j = 1
i = 0 ⇒ 1

j = 2
i = 0 ⇒ 2

left min[n]

left-min[i] ⇒ min element encountered in arr[0 .... i]

indexes

0	1	2	3
3	0	2	1

→ -1

0	1	2	3
2	3	4	5

⇒

0	1	2	3
3	0	0	0

j = 1

↪ left min[n-2]

arr   arr[0] will never be our i

val index

(2,3)
(3,0)
(4,2)
(5,1)

min index ⇒ arr[0]. index ⇒ 3

j = 0 { arr[i]. index }

ans j-i ⇒ $\boxed{-3}$

min index = 0

j = 2 { arr [2]. index }

ans ⇒ 2-0 ⇒ 2

min.index = 0

j = 1 { arr [3].index }

ans ⇒ 1-0 ⇒ 1

min_index ⇒ min { min_index, arr[i].index }

$$\# \quad \begin{array}{ccccc} 0 & 1 & 2 & 3 & 4 \\ \hline 1 & 2 & 3 & 4 & 5 \end{array}$$

$\boxed{-1}$

$$\begin{pmatrix} (1,0) \\ (2,1) \\ (3,2) \\ (4,3) \\ (5,4) \end{pmatrix} \Rightarrow \boxed{4}$$

$$\begin{array}{cccccc} & 0 & 1 & 2 & 3 & 4 \\ \# & [\,5, & 4 & 3 & 2 & 1\,] \\ & & & & j & i \end{array}$$

$A[j] \geq A[i]$

$j-1$

$$\left(\begin{array}{c}(1,4)\\(2,3)\\(3,2)\\(4,1)\\(5,0)\end{array}\right)\begin{array}{l} \\ \Rightarrow -1 \\ \Rightarrow -1 \\ \\ \\ \end{array}$$

TC: $O(n \log n)$

```
              arr, Arraylist
#   vector<pair<int, int>> vec;

      vec.push_back(make_pair(arr[i], i));
```

Q2 Given a matrix of size NxM, find the sum of all submatrix sum. /.

Ans

$$\begin{array}{c|cc} & 0 & 1 \\ \hline 0 & 3 & 1 \\ 1 & -1 & -2 \\ 2 & 2 & 4 \end{array} \Rightarrow \left[\begin{array}{l} [3],\ [3,1]\ \begin{bmatrix}3\\-1\end{bmatrix}\ \begin{bmatrix}3&1\\-1&-2\end{bmatrix} \\ \begin{bmatrix}3\\-1\\2\end{bmatrix}\ \begin{bmatrix}3&1\\-1&-2\\2&4\end{bmatrix},\ [1],\ \begin{bmatrix}1\\-2\end{bmatrix} \\ \begin{bmatrix}1\\-2\\4\end{bmatrix}\ [-1]\ [-1,-2]\ \begin{bmatrix}-1\\2\end{bmatrix} \\ \begin{bmatrix}-1&-2\\2&4\end{bmatrix}\ [-2]\ \begin{bmatrix}-2\\4\end{bmatrix},\ [2],\ [2,4] \\ [4] \end{array} \right]$$

$$\text{Sum} \Rightarrow (3\times6)+(1\times6)+(-1\times8)+(-2\times8)$$
$$+(2\times6)+(4\times6) \Rightarrow \boxed{36}$$

$$[a,b] \Rightarrow b-a+1$$

$$[j,n-1] \Rightarrow n-\cancel{1}-j+\cancel{1} = (n-j)$$

	0	1	2	3	4	5	6
0	TL	TL	TL	TL			
1	TL	TL	TL	TL			
2	TL	TL	TL	TL			
3	TL	TL	TL	TL BR	BR	BR	BR
4				BR	BR	BR	BR
5				BR	BR	BR	BR
6				BR	BR	BR	BR
7				BR	BR	BR	BR

$(i,j) \Rightarrow (3,3)$

no of TL ⇒ $(i+1) \times (j+1)$

no of BR ⇒ $(n-i) \times (m-j)$

$20 + 20 + 20 + 20 + 20$

— — — — — — - - ⇒ 16 times

$16 \times 20 \Rightarrow \boxed{320}$

Break: $\boxed{10:45}$

Q3 Given a 2D Matrix, every row sorted, every column sorted. Find an element K.

n = rows
m = columns

K=15

$$\begin{array}{c|cccccc}
 & 0 & 1 & 2 & 3 & 4 & 5 \\
\hline
0 & -1 & 2 & 4 & 5 & 9 & 11 \\
1 & 1 & 4 & 7 & 8 & 10 & 14 \\
2 & 3 & 7 & 9 & 10 & 12 & 18 \\
3 & 6 & 10 & 12 & 14 & 16 & 20 \\
4 & 9 & 13 & 16 & 19 & 22 & 24 \\
5 & 11 & 15 & 19 & 21 & 24 & 27 \\
6 & 14 & 20 & 25 & 29 & 31 & 39 \\
7 & 18 & 24 & 29 & 32 & 34 & 42
\end{array}$$

Brute Force 1: Iterate on every element: TC: O(mn)

Brute Force 2: Iterate on each row and do binary search TC: O(n log m)

Brute Force 3: Iterate on each column and do binary search TC: O(m log n)

K=15

	0	1	2	3	4	5
0	-1	2	4	5	9	11
1	1	4	7	8	10	14
2	3	7	9	10	12	18
3	6	10	12	14	16	20
4	9	13	16	19	22	24
5	11	15	19	21	24	27
6	14	20	25	29	31	39
7	18	24	29	32	34	42

```
i = 0 , j = m-1

while ( j≥0 && i<n ) {
    if (arr[i][j] > k) {
        // ignore below
        j--;
    } else if (arr[i][j] < k) {
        // ignore left
        i++;
    } else
        return true;
    }
}
return false.
```

TC : O(m+n)
SC : O(1)

i++ = A , j-- = B

$$\underbrace{\boxed{A}\ A, B, B, A, B, A, B \ldots}_{(n+m)} \Rightarrow$$

6x4

	0	1	2	3
0	TL	TL	TL	
1	TL	TL	TL	
2	TL	TL	TL	
3	TL	TL	TL BR	BR
4			BR	BR
5			BR	BR

TL = 12

BR => 6

6 + 6 + 6
+ 6 + 6

12 x 6 => $\boxed{72}$

$\boxed{72 \times arr[i][j]}$