Problem Solving Session 1

1. ADD OR NOT
2. find Smallest Again
3. Largest Rectangle in Histogram
   ↳ Max Rectangle in Binary Matrix

ADD OR NOT

Given an array A[N] & integer B.

In a single operation, you can increase any a[i] by 1.

You are allowed to do at most B such operations.

find the no. with the maximum no. of occurances.

If there are multiple such numbers, find minimum one.

A = [3 1 2 2 1] B = 3

(+1) (+1)

[3 2 2 2 2]

ans = [4, 2]

frequency, number

A = [5 , 5 , 5] B = 3

ans = [3, 5]

Sort array

A = [1 1 2 2 3]

Brutforce

```
sort(array)
ans = 0
num = -1
for(i=0 to n-1) {
    int c = 1;
    int op = B;
    for(j=i-1 to 0) {
        if( a[i] - a[j] <= op) {
            c++
            op -= a[i] - a[j]
        }
        else
            break
    }
    if(ans < c) {
        ans = c;
        num = a[i]
    }
```

TC = O(N²)

SC = O(1)

```
}
return [ans, num]
```

$A = [\ 1 \quad 1 \quad 2 \quad 2 \quad 3\ ]$ $\quad B=3$

ans = 0 1 2 3 4

num = 1 1 1 2 2

op = 3 2 1 $\quad c=3$

$1 <= N <= 10^5$

Do binary search to find out how many elements can become equal to a[i] in <=B operations.

$A = [\ 1\ \overset{l}{[}1 \quad 2 \quad 2\overset{r}{)}\ 3\ ]$

a[i]

Can we make this range of elements equal to a[i]

$\Rightarrow$ 3 - 1
+ 3 - 2
+ 3 - 2

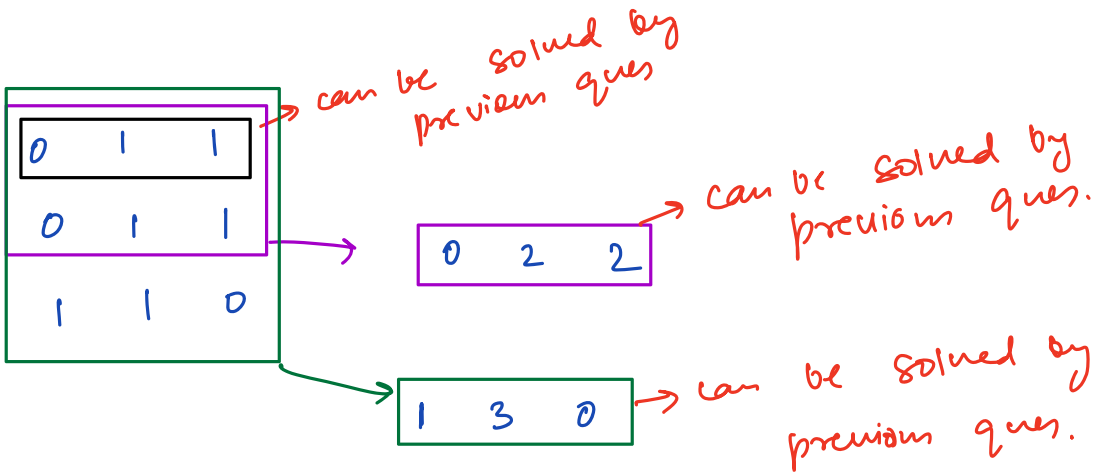
$\Rightarrow$ 3 * 3 - (1 + 2 + 2)

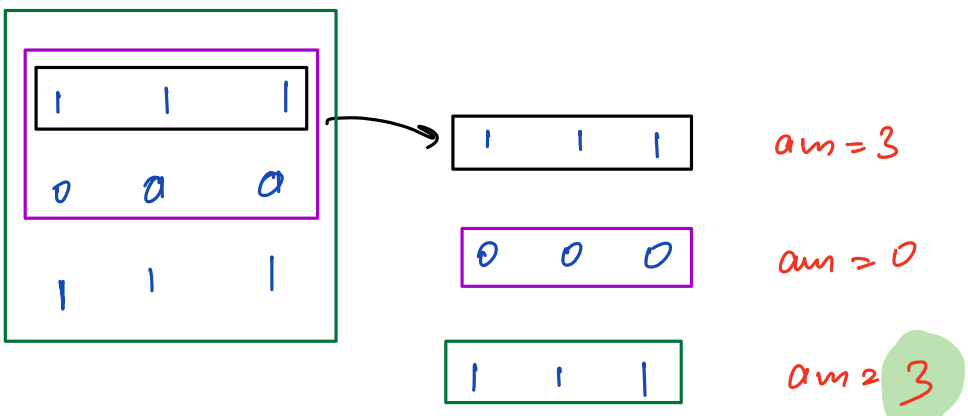
$\Rightarrow$ 3 * 3 - (sum of elements from l to r)

Largest Rectangle in Histogram

TC = O(N) SC = O(N)

Max Rectangle in Binary Matrix





TC = O(N x M)

SC = O(M)

find Small Again

Given array A[n]

If we store sum of each triplet in a list, find the B^{th} smallest element in list.

$A = [\underset{0}{2} \quad \underset{1}{4} \quad \underset{2}{3} \quad \underset{3}{2}]$ $\quad B = 3$

(0,1,2) → 2+4+3 = 9

(0,1,3) → 8

(0,2,3) → 7

(1,2,3) → 9

⇒ 7, 8, 9, 9 (↑ 3rd smallest)

Sort the array

$A_2 = [2 \quad 2 \quad 3 \quad 4]$

l = smallest ans = a[0]+a[1]+a[2]

r = largest ans = a[n-1] + a[n-2] + a[n-3]

do binary search in [l, r]

```
while ( l <= r) {
    mid = l + (r-l)/2
    // how to check if mid is answer
    -> now many triplet sums is less than mid
```

many thing

A = [1 2 3 [5 7]] mid = 13

1 + 2 + 7 = 10 c += 3

1 + 3 + 7 = 11 c += 2

1 + 5 + 7 = 13

2 + 3 + 7 = 12 c += 2

2 + 5 + 7 = 14

c = 7

3 + 5 + 7 = 15

Codes link

https://ideone.com/sEQttU