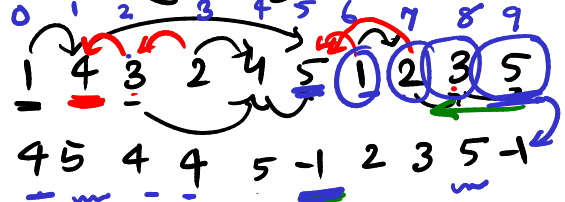


Recap: Stacks  $\rightarrow$  problems

pseudocode: Next Greater Right\*  
 backwards 1 forward 2

1. NGR (next greater ele  $\rightarrow$  right)



ngr:

4 5 4 4 5 -1 2 3 5 -1

ngr\_i:

1 5 4 4 5 -1 7 8 9 -1

ngl:

-1 -1 4 3 -1 5 5 5 -1

$O(n)$

put all elements

greater elements

next smaller right nsl

$i = 0$  to  $n-1$   $i++ \rightarrow$  nsl

for (int i = n-1, i >= 0, i--):  
 while (!s.empty() and  $am[s.top()] \leq am[i]$ ):  
 s.pop()  
 if s.empty(): ans.push(-1)  
 else: ans.push(s.top())  
 s.push(am[i])  $\leftarrow$  every element

① Stock span problem

② Max area under histogram

③ Rainwater trapping problem

} classics.

Q.1  
 am = [8, 10, 12, 16, 13, 11, 12, 14, 10, 15]  
 span = [1, 1, 1, 7, 3, 1, 1, 2, 1, 1]  
 ngr = [10, 12, 16, -1, 14, 12, 14, 15, 15, -1]  
 $\rightarrow$  ngr\_i = [1, 2, 3, 10, 7, 6, 7, 9, 9, 10]  
 ngr\_i - i = [1, 1, 1, 7, 3, 1, 1, 2, 1, 1]  
 = span

span = if I buy the stock today how many days after I have to sell it.

Sell profitably. If you bought the stock at peak, you sell it eventually by force.

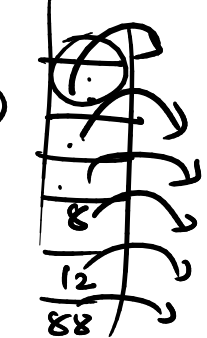
3 4 5 7 8 12 88 -1  
 99 1 3 4 5 7 8 12 88

$O(n)$

+  $O(n)$

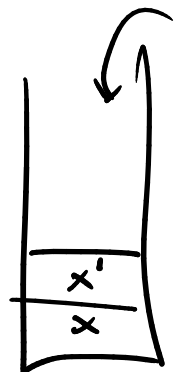
deletion

$O(2n)$



$O(n)$

$x' > x$   
 $x' > z$

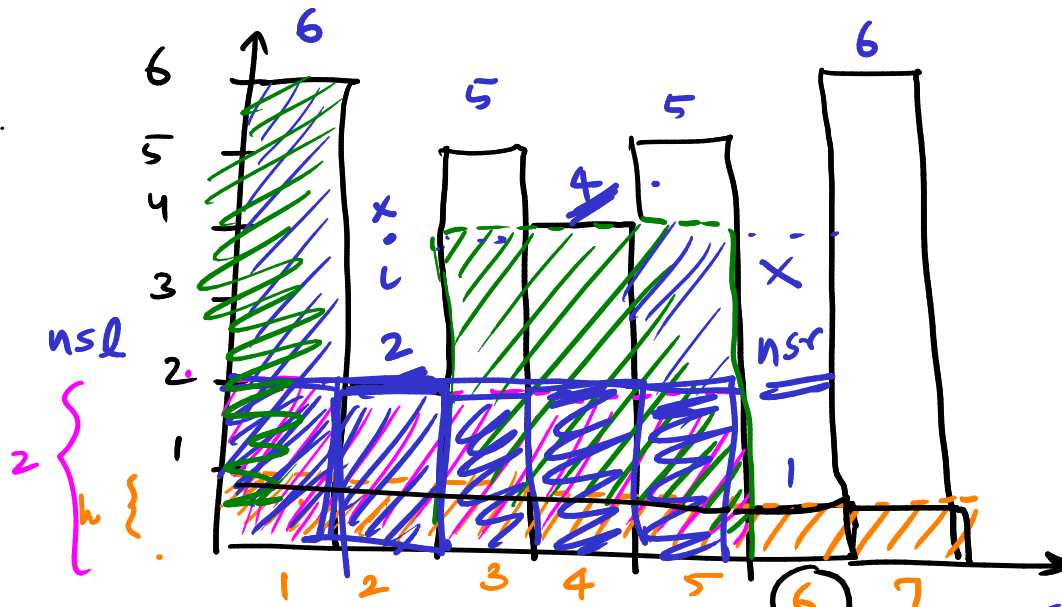


② Max area under histogram :

an = [6, 2, 5, 4, 5, 1, 6]

1 unit wide.

6-6  
②



⇒ 7

⇒ 10

⇒ 12

dp: 12

Assume height = an[i]

an[i]  
h<sub>1</sub> = 6

h<sub>2</sub> = 2

h<sub>3</sub> = 5

an[i] × width  
area<sub>1</sub> = 6 × 1

area<sub>2</sub> = 2 × 5 = 10

area<sub>3</sub> = 5 × 1 = 5

i → i: 0 1 2 3 4 5 6 7

an[i]: 6 2 5 4 5 1 6

dem { nsr : 2 1 4 1 1 -1 -1 → if -1 in nsr, i = n  
nsl : -1 -1 2 2 4 -1 1

{ hsr-i : 1 5 3 5 5 7 7  
nsl-i : -1 -1 1 1 3 -1 5

→ if -1 in nsl, i = -1

width : 1 5 1 3 1 7 1

width = (i - nsl-i) + (nsr-i - i) - 1

how many bars support me on left

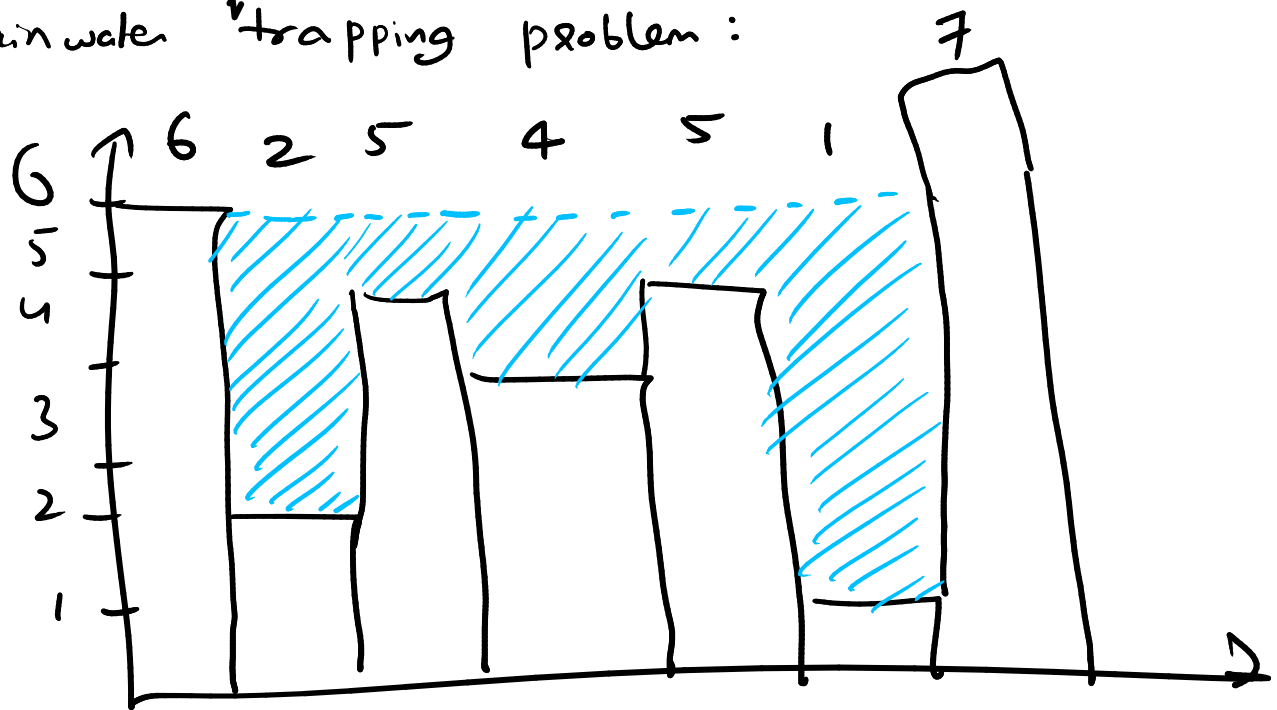
how many bars are on right

adjust because you are counting other bar twice

width = nsr-i - nsl-i - 1

area[i] = width[i] \* an[i]

③ Rain water trapping problem :



Water:

0 4 1 2 1 5 0

o/p:

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