Rain Water Trapped

02 December 2023 12:08 AM

Problem Description
Given a vector **A** of non-negative integers representing an elevation map where the width of each bar is 1, compute how much water it is able to trap after raining.
From < https://www.scaler.com/academy/mentee-dashboard/class/90012/assignment/problems/47>

Problem Constraints
1 <= **|A|** <= 100000

Input Format
First and only argument is the vector **A**

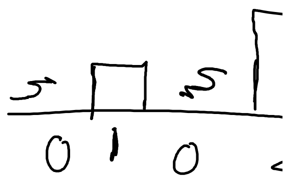
Output Format
Return one integer, the answer to the question

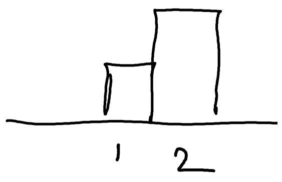
Input 1:
A = [0, 1, 0, 2]

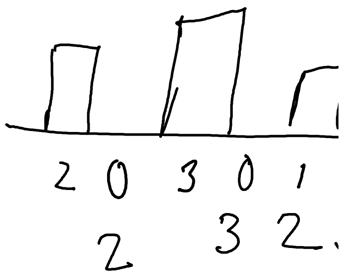
Input 2:
A = [1, 2]

Output 1:
1

Output 2:
0







Bruteforce :-

iterate over each Index of an vector.
Find out the left highest & right highest element
take the min from both & Substract it from Current Inde
& Calculate the sum of all values.

T.C. $O(n^2)$
S.C $O(1)$

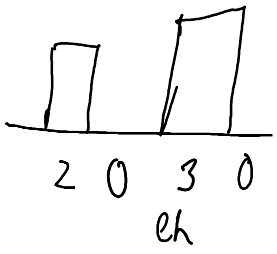
—— x —— x —— x —— x —— x ——

Optimization :- Prefix Sum

eg :- [2, 0, 3, 0, 1, 0, 1, 2, 4] = 13

rh = [4, 4, 4, 4, 4, 4, 4, 4, 4]

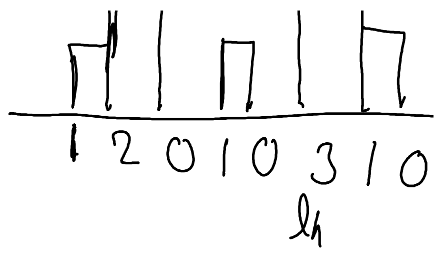
Min(lh, rh) - A[i]
if (i > lh)
 lh = i



0 2 0 3 :

eg :- [1, 2, 0, 1, 0, 3, 1, 0, 1, 0, 4, 1] = 15
rh = [illegible]

[illegible]



0 0 2 1 2 0 2 3

Solution :- Calcuate the righ highest element using pre & Iterate over the Input array calculate the value lh element if it is greater the the Current Replace it with current element taking the min & Substracting the current element.
& Suming all the values in the end.

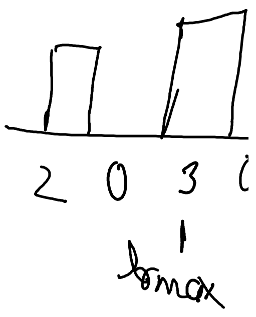
T.C. O(n) — Creating prefix righ highest
O(n) — to find the anser.
= O(2n) = O(n)

S.C. O(n) — for PSum array.

—x —x —x —x —x —x —x

Optimization using pointers :-

eg:- [2, 0, 3, 0, 1, 0, 1, 2, 4] = 13



l = 0
r = n - 1
lmax = 0
rmax = 0

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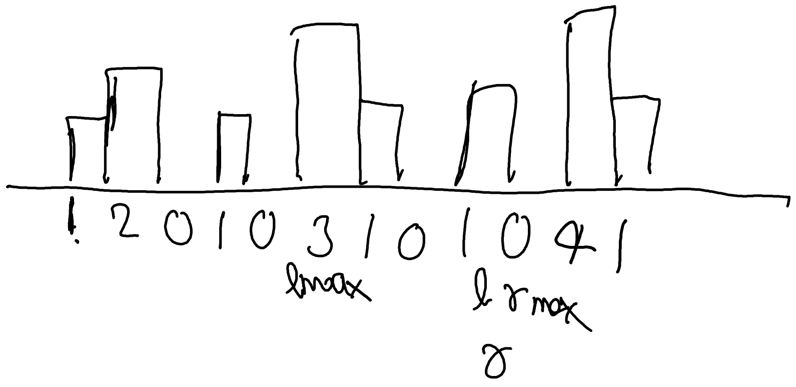
total = 0
while (l <= r) {
  if (lmax <= rmax) {
    int sum = lmax - A.get(l);
    if (sum > 0) {
      total += sum;
    } else {
      lmax = A.get(l);
    }
    l++
  } else {
    int sum = rmax - A.get(r);
    if (sum > 0) {
      total += sum;
    } else {
      rmax = A.get(r);
    }
    r--;
  }
}
return total;
```

l = 0
r = 8

lmax = 3
rmax = 4
total = 2 + 3 + 2 +

2)



l = 0
r = 11
lmax = 3
rmax = 4
total = 2

⇒

[illegible]

Solution :- Use two pointer approach use four variables

initialice l to be 0 & r to last Index of Vect

be 0 & iterate till r<=r If lmax <= rmax ca

Substracting Curren element from lmax If it is

add it in the output total. else assign the Current

lmax. & Inrement the l

Whereas If rmax > lmax Calculate the sum by

Current element from lmax if it is great

add it in the output total. else assign the

to the rmax & decrement r

T.C. = O(n)

S.C = O(1)