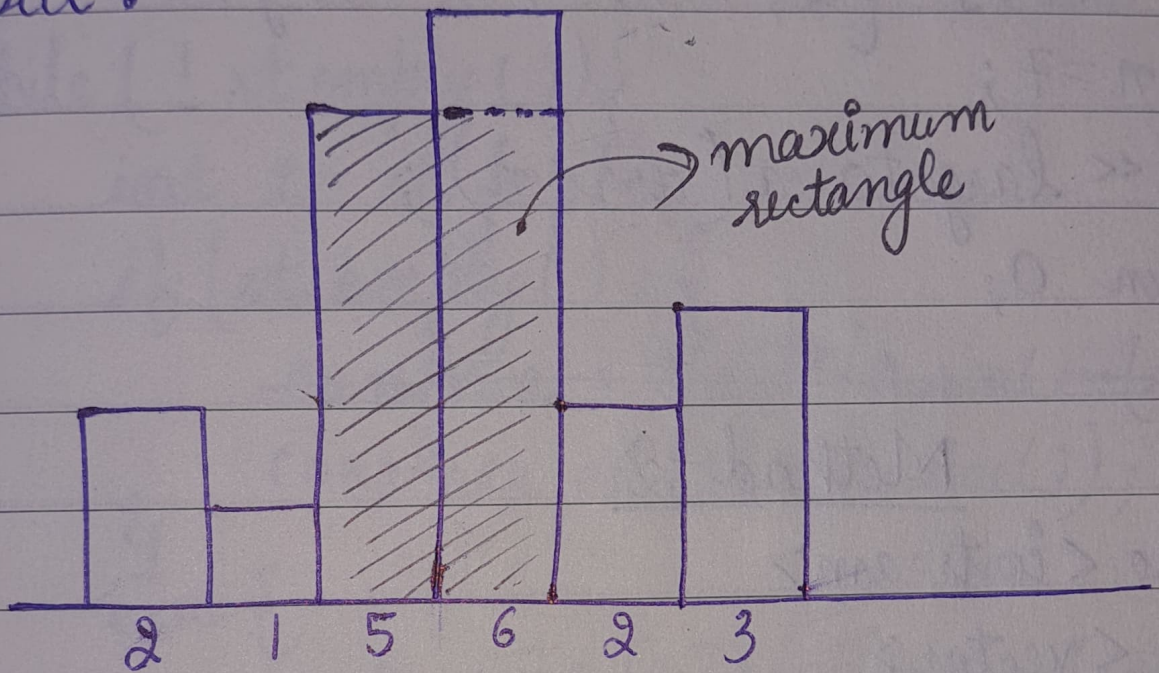
Largest Rectangle in Histogram

Que Given an array. Each element represents the height of the histogram's bar and the width of each bar is 1, Find the area of larg-est rectangle in the histogram.

Sol Input : Array = {2, 1, 5, 6, 2, 3}

Output :



Dry run

Inputs: 2 1 5 6 2 3 1

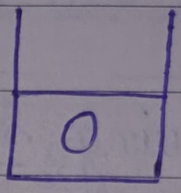
Index: 0 1 2 3 4 5 6 = i

Here n = 8, int i=0, a.push_back(0);

Step-1 i=0, empty ✓ stack ✓ so

Push i=0 in stack.

i++;



Step-2 i=1, empty X, a[st.top()] > a[i]

a[0] > a[i]

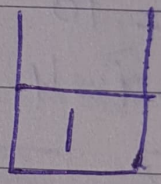
2 > 1 ✓

so t = 0, h = a[0] = 2, pop()=0

stack empty ✓, ans = max(0, 2*1)

= 2

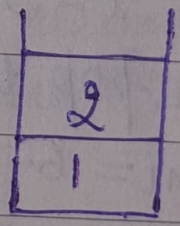
Push i = 1 and i++;



Step-3 i=2, empty X, a[1] > a[2]

1 > 5 X

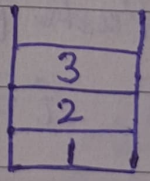
Push i = 2 in stack, i++;



Step-4 i=3, empty X, a[2] > a[3]

5 > 6 X

Push i=3 and i++;



Step-5 i=4, empty X, a[3] > a[4]

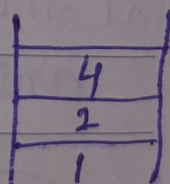
6 > 2 ✓

t = 3, h = a[3] = 6, pop top element;

stack is not empty. len = 4-2-1 = 1, ans = max(2, 6*1)

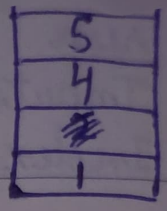
= 6

~~Push i=4 and i++;~~



Step-6 i=5, empty X and a[4] > a[5]
2 > 3 X

Push i=5 and i++;



Step-7 i=6, empty X and a[5] > a[6]
3 > 1

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continuing Step-5 ; i=4, empty X, a[2] > a[4]
5 > 2 ✓

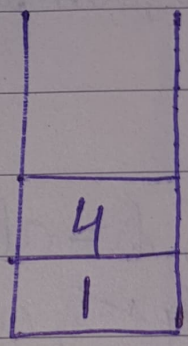
t=2, h=a[2]=5

Now pop 2.

len = 4-1-1=2

ans = max(6, 5*2)
= 10

Push i=4 and i++



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continuing step-7 i=6

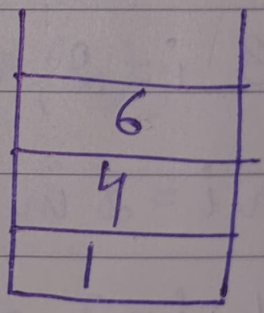
t=5, h=a[5]=3

pop top element so 5 popped

len = 6-4-1 = 1

ans = max(10, 3*1) = 10

Push i=6, i++



Step-8; i=7, empty X, a[6] > a[7]
1 > Nothing

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at the end we get
ans = 10