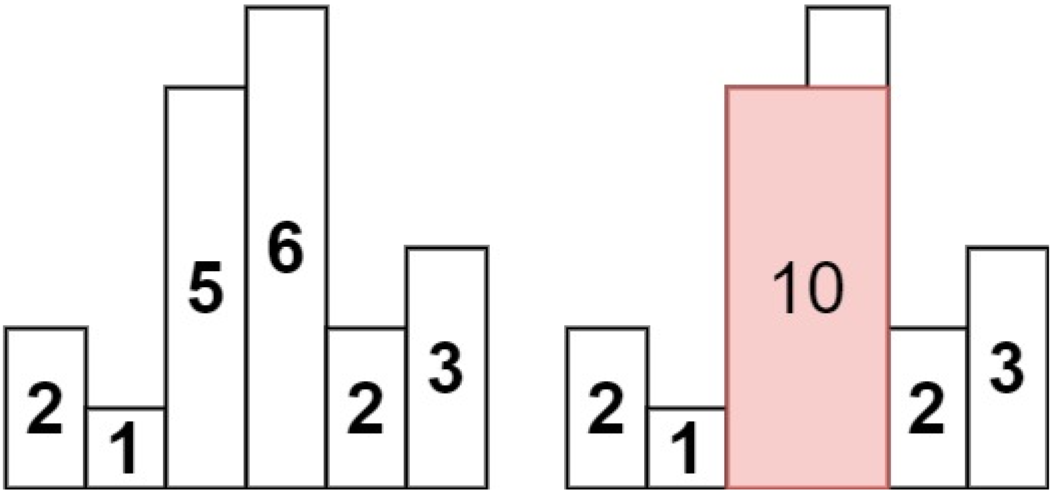
84. Largest Rectangle in Histogram

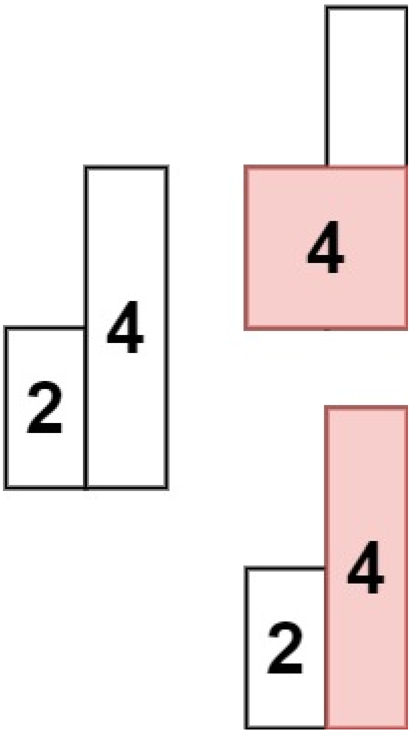
Given an array of integers `heights` representing the histogram's bar height where the width of each bar is `1`, return *the area of the largest rectangle in the histogram*.

Example 1:



```
Input: heights = [2,1,5,6,2,3]
Output: 10
Explanation: The above is a histogram where width of each bar is 1.
The largest rectangle is shown in the red area, which has an area = 10
units.
```

Example 2:



```
Input: heights = [2,4]
Output: 4
```

Constraints:

- `1 <= heights.length <= 10<sup>5</sup>`
- `0 <= heights[i] <= 10<sup>4</sup>`

```python
class Solution:
    def largestRectangleArea(self, heights: List[int]) -> int:
        n = len(heights)
        smallestRight = [None]*n
        smallestLeft = [None]*n
        stack = []
        for i in range(n-1,-1,-1):
            while len(stack)>0 and heights[i]<=heights[stack[-1]]:
                stack.pop()
            smallestRight[i] = stack[-1] if len(stack) else n
            stack.append(i)
        stack = []

        for i in range(n):
            while len(stack)>0 and heights[i]<=heights[stack[-1]]:
                stack.pop()
            smallestLeft[i] = stack[-1] if len(stack) else -1
            stack.append(i)

        # print(smallestRight)
        # print(smallestLeft)
        maxArea = 0
        for i in range(n):
            width = abs(smallestRight[i]-smallestLeft[i])-1
            area = width*heights[i]
            maxArea = max(maxArea,area)
        return maxArea
```