08 Sum of Subarray Ranges

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2104. Sum of Subarray Ranges

Medium | Topics | Companies | Hint

You are given an integer array `nums`. The **range** of a subarray of `nums` is the difference between the largest and smallest element in the subarray.

Return *the **sum of all** subarray ranges of* `nums`.

A subarray is a contiguous **non-empty** sequence of elements within an array.

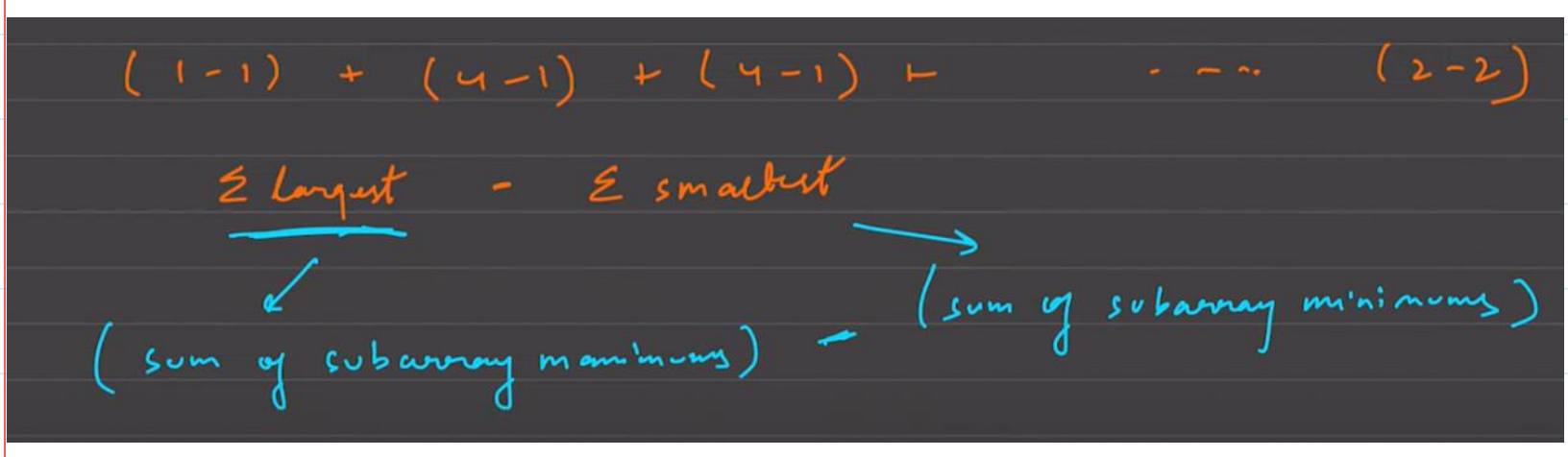
Example 1:

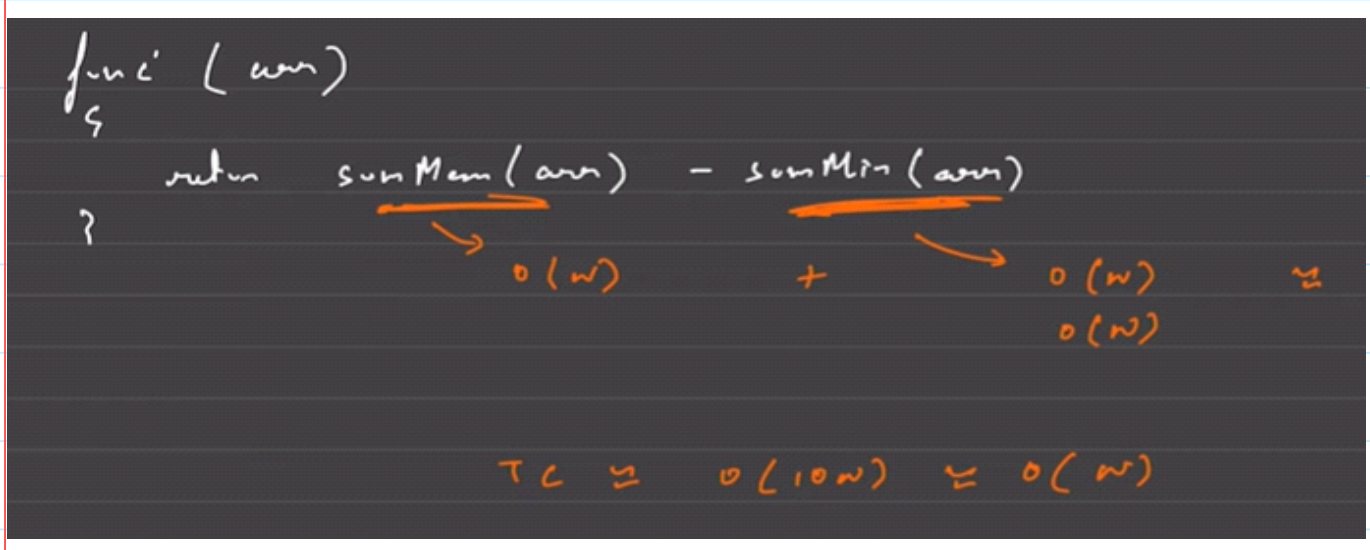
```
Input: nums = [1,2,3]
Output: 4
Explanation: The 6 subarrays of nums are the following:
[1], range = largest - smallest = 1 - 1 = 0
[2], range = 2 - 2 = 0
[3], range = 3 - 3 = 0
[1,2], range = 2 - 1 = 1
[2,3], range = 3 - 2 = 1
[1,2,3], range = 3 - 1 = 2
So the sum of all ranges is 0 + 0 + 0 + 1 + 1 + 2 = 4.
```


```
public long subArrayRanges(int[] nums)
{
    long ans =0 , n=nums.length;
    for(int i=0;i<n;i++){
      int min=nums[i] , max =nums[i];
      for(int j=i;j<n;j++){
        min=Math.min(min,nums[j]);
        max=Math.max(max,nums[j]);
         ans+=(max-min);
      }
    }
    return ans;
  }
```

Time complexity :- O(N^2)

Second Approach ... Method-2 : find the sum of largest element inside the each subarray, find the sum of smallest element inside the sub array, Then, return The return it's difference...





code

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```
class Solution {
    public long subArrayRanges(int[] nums) {
        return (sumOfLargest(nums)-sumOfSmallest(nums));
    }
_____
_____

    public static long sumOfLargest(int[] nums){
        int[] nge=nge(nums);
        int[] pnge=pnge(nums);
        long ans=0;

        for(int i=0;i<nums.length;i++){
            long a=nge[i]-i;
            long b=i-pnge[i];
            long c=a*b;
            ans+=(c*nums[i]);
        }
        return ans;
    }
_____
_____

    public static long sumOfSmallest(int[] nums){
        int[] nse=nse(nums);
        int[] pnse=pnse(nums);
        long ans=0;
        for(int i=0;i<nums.length;i++){
            long a=nse[i]-i;
            long b=i-pnse[i];
            long c=a*b;
            ans+=(c*nums[i]);
        }
        return ans;
    }
_____
_____

    public static int[] nge(int[] arr){
        int[] ans=new int[arr.length];
        Stack<Integer> stack=new Stack<>();
        int n=arr.length;
        for(int i=n-1;i>=0;i--){
            while(!stack.isEmpty() && arr[i]>=arr[stack.peek()])
            stack.pop();
            ans[i]=(stack.isEmpty())?n:stack.peek();
            stack.push(i);
        }
        return ans;
    }
_____
_____

    public static int[] pnge(int[] arr){
        int[] ans =new int[arr.length];
        Stack<Integer> stack=new Stack<>();
        int n=arr.length;
        for(int i=0;i<n;i++){
            while(!stack.isEmpty() && arr[i]>arr[stack.peek()])
            stack.pop();
            ans[i]=(stack.isEmpty())?-1:stack.peek();
            stack.push(i);
        }
        return ans;
    }
_____
_____

    public static int[] nse(int[] arr){
        int[] ans=new int[arr.length];
        Stack<Integer> stack=new Stack<>();
        int n=arr.length;
        for(int i=n-1;i>=0;i--){
            while(!stack.isEmpty() && arr[i]<=arr[stack.peek()])
            stack.pop();

            ans[i]=stack.isEmpty()?n:stack.peek();
            stack.push(i);
        }
        return ans;
    }
_____
_____

    public static int[] pnse(int[] arr){
        int[] ans=new int[arr.length];
        Stack<Integer> stack=new Stack<>();
        int n=arr.length;
        for(int i=0;i<n;i++){
            while(!stack.isEmpty() && arr[i]<arr[stack.peek()])
            stack.pop();

            ans[i]=stack.isEmpty()?-1:stack.peek();
            stack.push(i);
        }
        return ans;
    }
}
```