2023-12-02 - Handout – Monotonic Stack

Q1. Next Greater Element

Link: https://leetcode.com/problems/next-greater-element-i/description/

The **next greater element** of some element x in an array is the **first greater** element that is **to the right** of x in the same array.

You are given two **distinct 0-indexed** integer arrays nums1 and nums2, where nums1 is a subset of nums2.

For each 0 <= i < nums1.length, find the index j such that nums1[i] == nums2[j] and determine the **next greater element** of nums2[j] in nums2. If there is no next greater element, then the answer for this query is -1.

Return *an array* ans *of length* nums1.length *such that* ans[i] *is the* ***next greater element*** *as described above.*

Example 1:

Input: nums1 = [4,1,2], nums2 = [1,3,4,2]
Output: [-1,3,-1]
Explanation: The next greater element for each value of nums1 is as follows:
- 4 is underlined in nums2 = [1,3,4,2]. There is no next greater element, so the answer is -1.
- 1 is underlined in nums2 = [1,3,4,2]. The next greater element is 3.
- 2 is underlined in nums2 = [1,3,4,2]. There is no next greater element, so the answer is -1.

Example 2:
Input: nums1 = [2,4], nums2 = [1,2,3,4]
Output: [3,-1]
Explanation: The next greater element for each value of nums1 is as follows:
- 2 is underlined in nums2 = [1,2,3,4]. The next greater element is 3.
- 4 is underlined in nums2 = [1,2,3,4]. There is no next greater element, so the answer is -1.

Q2. Daily Temperatures

Link: https://leetcode.com/problems/daily-temperatures/description/

Given an array of integers temperatures represents the daily temperatures, return *an array* answer *such that* answer[i] *is the number of days you have to wait after the* i^{th} *day to get a warmer temperature*. If there is no future day for which this is possible, keep answer[i] == 0 instead.

Example 1:

Input: temperatures = [73,74,75,71,69,72,76,73]
Output: [1,1,4,2,1,1,0,0]

Example 2:
Input: temperatures = [30,40,50,60]

Output: [1,1,1,0]

Q3. Shortest unsorted continuous subarray

Link: https://leetcode.com/problems/shortest-unsorted-continuous-subarray/

Given an integer array nums, you need to find one **continuous subarray** such that if you only sort this subarray in non-decreasing order, then the whole array will be sorted in non-decreasing order.

Return *the shortest such subarray and output its length*.

Example 1:
Input: nums = [2,6,4,8,10,9,15]
Output: 5
Explanation: You need to sort [6, 4, 8, 10, 9] in ascending order to make the whole array sorted in ascending order.

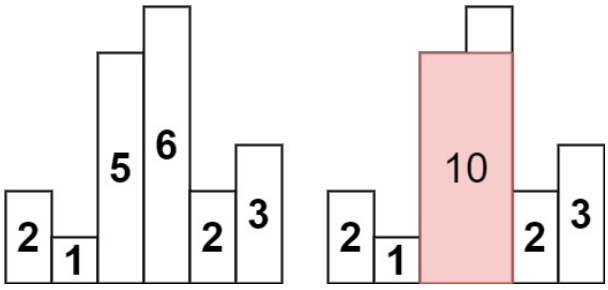
Example 2:
Input: nums = [1,2,3,4]
Output: 0

Example 3:
Input: nums = [1]
Output: 0

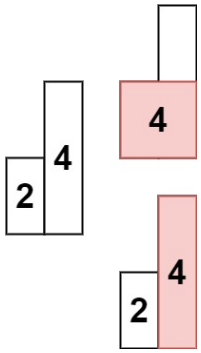
Q4. Largest Rectangle in Histogram

Link: https://leetcode.com/problems/largest-rectangle-in-histogram/description/

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*.



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.



Input: heights = [2,4]

Output: 4