BITTIGER

CLASS_7

ADVANCED LINEAR ALGORITHM

Ben Gong

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26. Remove Duplicates from Sorted Array

Given a sorted array, remove the duplicates in place such that each element appear only *once* and return the new length.

Do not allocate extra space for another array, you must do this in place with constant memory.

For example,

Given input array *nums* = `[1,1,2]`,

Your function should return length = `2`, with the first two elements of *nums* being `1` and `2` respectively. It doesn't matter what you leave beyond the new length.

- Total Accep
- Total Submi
- Difficulty: Ea
- Contributor:

10 min

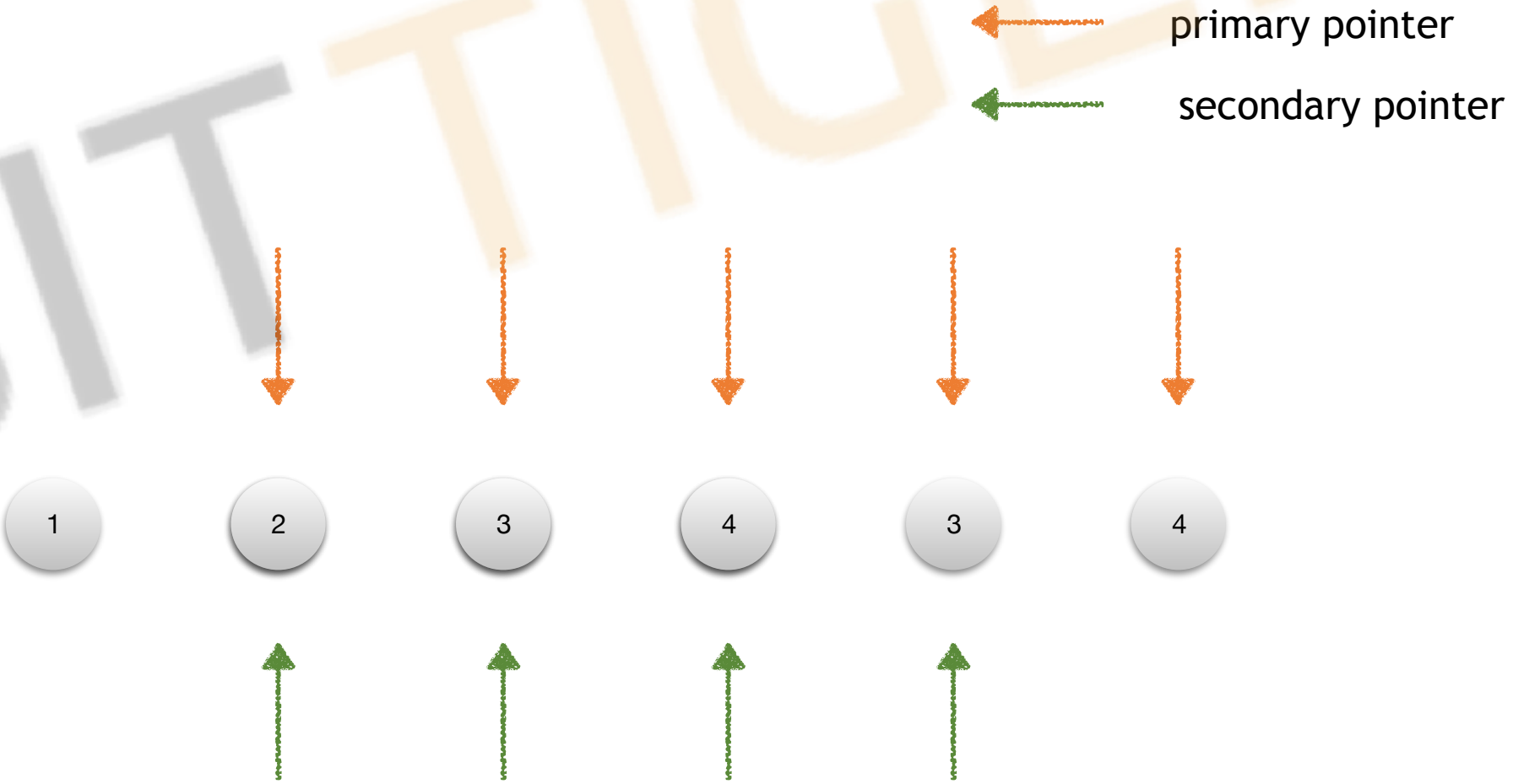
```
public int removeDuplicates(int[] nums) {

}
```

三种 two pointers 题目 （追及， 相遇， 相离）

追及问题

primary pointer —-> 主动pointer 遍历

secondary pointer ——>从动pointer 记录


primary pointer
secondary pointer
1
2
3
4
3
4

```java
public int removeDuplicates(int[] nums) {
    if(nums == null || nums.length == 0){
        return 0;
    }
    if(nums.length == 1){
        return 1;
    }
    int beg = 0;

    for(int i = 0; i < nums.length; i++){
        if(beg < 1 || nums[i] > nums[beg - 1]){
            nums[beg] = nums[i];
            beg++;
        }
    }

    return beg;
}
```

compare with secondary pointer

80. Remove Duplicates from Sorted Array II

Follow up for "Remove Duplicates":

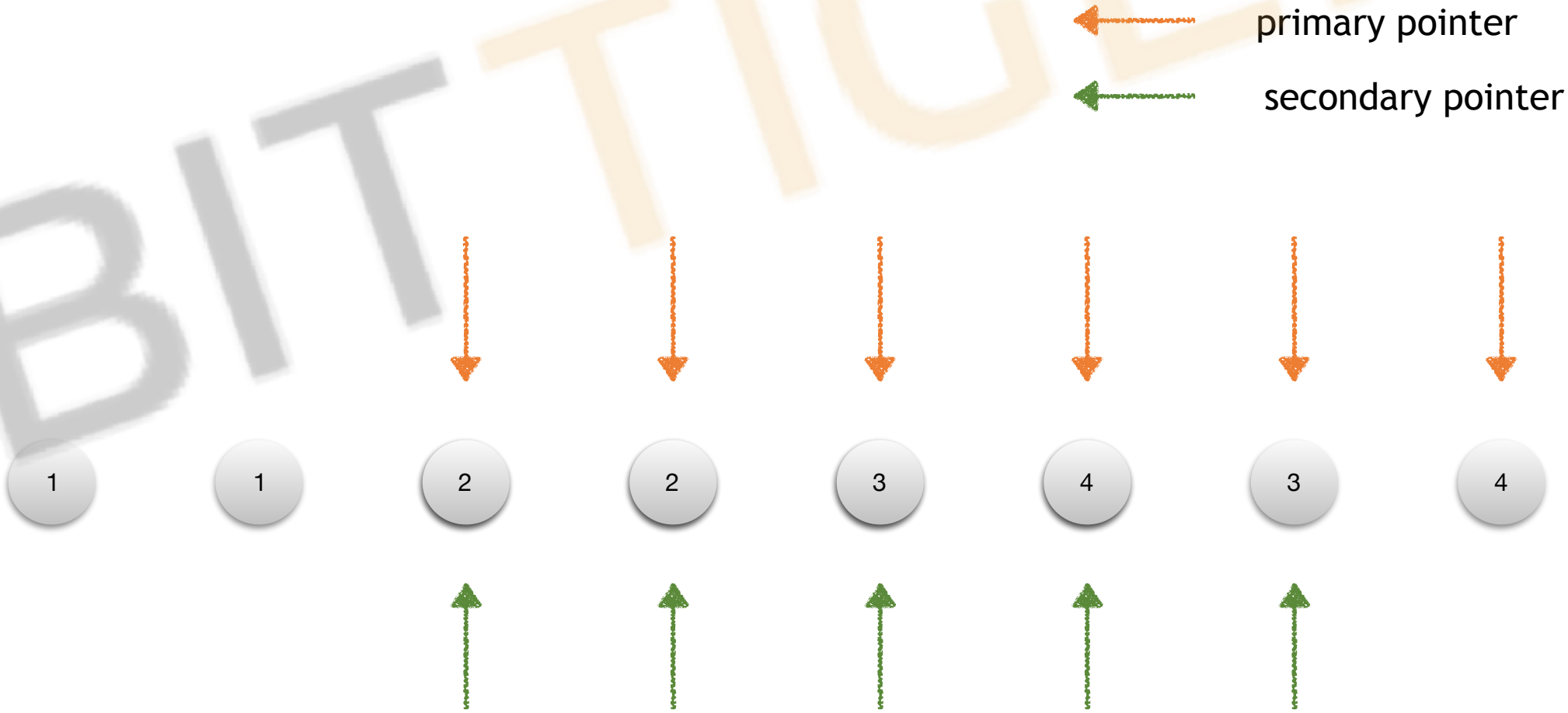
What if duplicates are allowed at most *twice*?

For example,

Given sorted array *nums* = `[1,1,1,2,2,3]`.

Your function should return length = `5`, with the first five elements of *nums* being `1`, `1`, `2`, `2` and `3`. It doesn't matter what you leave beyond the new length.

- Total Acce
- Total Subn
- Difficulty: I
- Contributo


primary pointer
secondary pointer
1
1
2
2
3
4
3
4

```
3   public int removeDuplicates(int[] nums) {
4       if(nums == null){
5           return 0;
6       }
7       if(nums.length <= 2){
8           return nums.length;
9       }
10
11      int pre = 0;
12
13      for(int i = 0; i < nums.length; i++){
14          if(pre < 2 || nums[i] > nums[pre - 2]){
15              nums[pre] = nums[i];
16              pre++;
17          }
18      }
19      return pre;
20  }
```

compare with the element before secondary pointer

3. Longest Substring Without Repeating Characters

Given a string, find the length of the **longest substring** without repeating characters.

Examples:

Given `"abcabcbb"`, the answer is `"abc"`, which the length is 3.

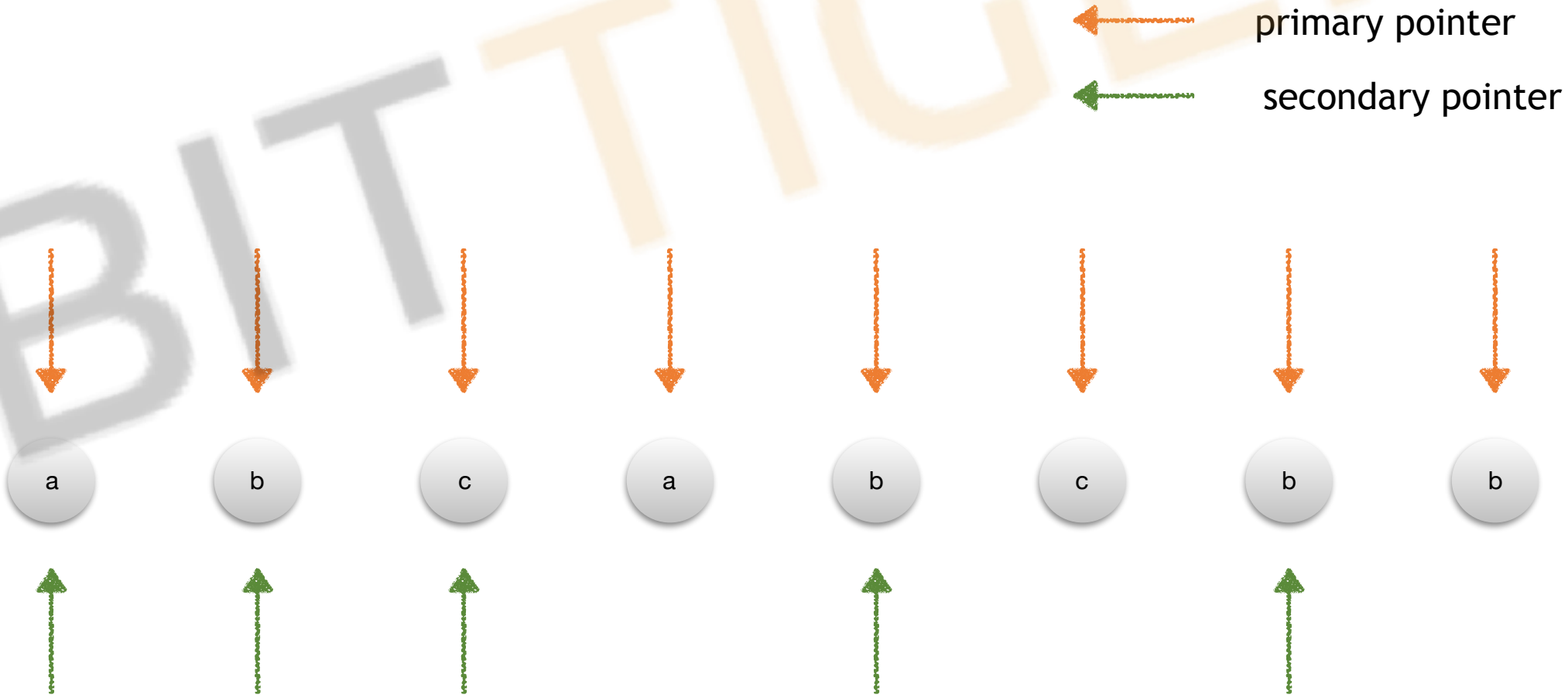
Given `"bbbbb"`, the answer is `"b"`, with the length of 1.

Given `"pwwkew"`, the answer is `"wke"`, with the length of 3. Note that the answer must be a **substring**, `"pwke"` is a *subsequence* and not a substring.

- Total
- Total
- Diffic
- Cont

10 min

```
public int lengthOfLongestSubstring(String s) {

}
```



HashMap 记录char对应 最新 坐标

```java
public int lengthOfLongestSubstring(String s) {
    if(s == null || s.length() == 0){
        return 0;
    }
    char[] str = s.toCharArray();
    int[] map = new int[256];

    int max = 0;
    int beg = 0;

    for(int i = 0; i < s.length(); i++){
        if(map[str[i]] == 0){
            max = Math.max(max, i - beg + 1);
        }else{
            beg = Math.max(beg, map[str[i]]);
            max = Math.max(max, i - beg + 1);
        }
        map[str[i]] = i + 1;
    }

    return max;
}
```

map 记录每个char出现的Most Right 位置

不需要挪动secondary pointer

挪动secondary pointer 到合法位置

159. Longest Substring with At Most Two Distinct Characters

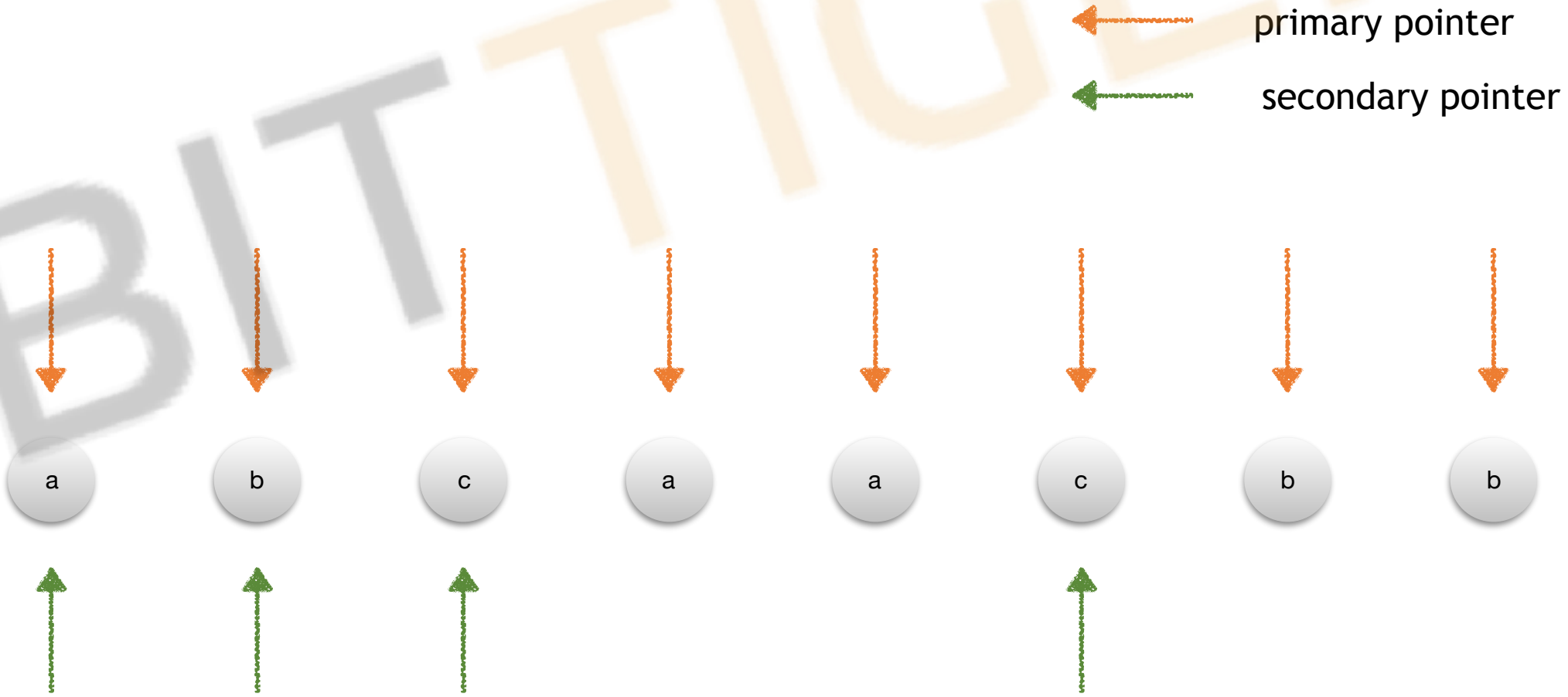
Given a string, find the length of the longest substring T that contains at most 2 distinct characters.

For example, Given s = `“eceba”`,

T is "ece" which its length is 3.

10 min

```
public int lengthOfLongestSubstringTwoDistinct(String str) {

}
```



HashMap 记录char对应 最新 坐标

```java
public int lengthOfLongestSubstringTwoDistinct(String str) {
    if(str == null || str.length() == 0){
        return 0;
    }

    Map<Character, Integer> map = new HashMap<>();

    int beg = 0;
    char[] strArray = str.toCharArray();
    int res = 0;

    for(int i = 0; i < str.length(); i++){
        if(map.size() < 2 || (map.size() == 2 && map.containsKey(strArray[i]))){
            // meet the requirement
            map.put(strArray[i], i);
        }else{
            // do not meet. replace most left one
            int left = i;
            for(int val: map.values()){
                left = Math.min(left, val);
            }
            beg = left + 1;
            map.remove(strArray[left]);
            map.put(strArray[i], i);
        }

        res = Math.max(res, i - beg + 1);
    }

    return res;
}
```

小于等于2个char 不需挪动 secondary pointer

大于2个char 挪动 secondary pointer

340. Longest Substring with At Most K Distinct Characters

Given a string, find the length of the longest substring T that contains at most *k* distinct characters.

For example, Given s = `“eceba”` and k = 2,

T is "ece" which its length is 3.

```java
public int lengthOfLongestSubstringKDistinct(String s, int k) {
    if(s == null || s.length() == 0 || k == 0){
        return 0;
    }

    Map<Character, Integer> map = new HashMap<>();

    int beg = 0;
    int res = 0;
    char[] str = s.toCharArray();

    for(int i = 0; i < s.length(); i++){
        if(map.size() < k || (map.size() == k && map.containsKey(str[i]))){
            map.put(str[i], i);
        }else{
            int left = i;
            for(int val: map.values()){
                left = Math.min(left, val);
            }
            beg = left + 1;
            map.remove(str[left]);
            map.put(str[i], i);
        }
         res = Math.max(res, i - beg + 1);
    }

    return res;
}
```

change to k

41. First Missing Positive

Given an unsorted integer array, find the first missing positive integer.

For example,

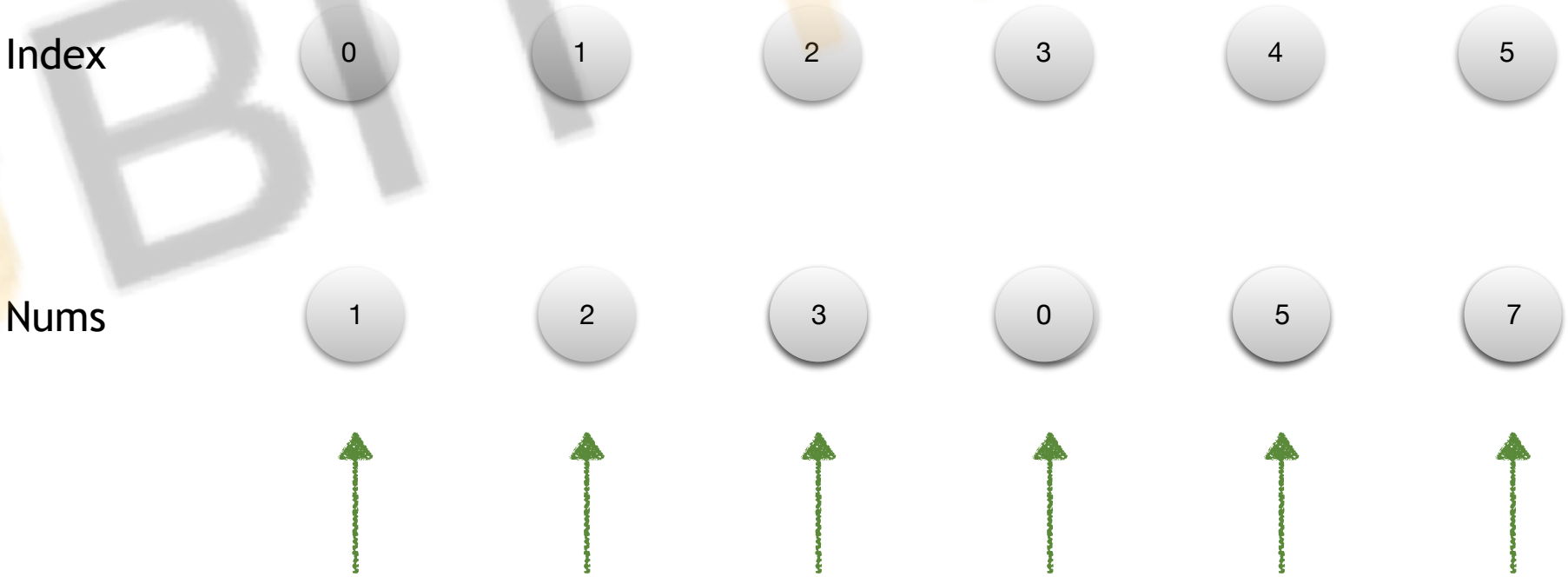
Given `[1,2,0]` return `3`,

and `[3,4,-1,1]` return `2`.

Your algorithm should run in $O(n)$ time and uses constant space.

10 min

```
public int firstMissingPositive(int[] nums) {

}
```


Index
0
1
2
3
4
5
Nums
1
2
3
0
5
7

```java
public int firstMissingPositive(int[] nums) {
    if(nums == null || nums.length == 0){
        return 1;
    }
    for(int i = 0; i < nums.length; i++){
        if(nums[i] - 1 >= 0 && nums[i] - 1 < nums.length && nums[nums[i] - 1] != nums[i]){
            swap(nums, i, nums[i] - 1);
            i--;
        }
    }

    for(int i = 0; i < nums.length; i++){
        if(nums[i] != i + 1){
            return i + 1;
        }
    }

    return nums.length + 1;
}

private void swap(int[] nums, int i, int j){
    int temp = nums[i];
    nums[i] = nums[j];
    nums[j] = temp;
}
```

Index based

239. Sliding Window Maximum

Given an array *nums*, there is a sliding window of size *k* which is moving from the very left of the array to the very right. You can only see the *k* numbers in the window. Each time the sliding window moves right by one position.

For example,

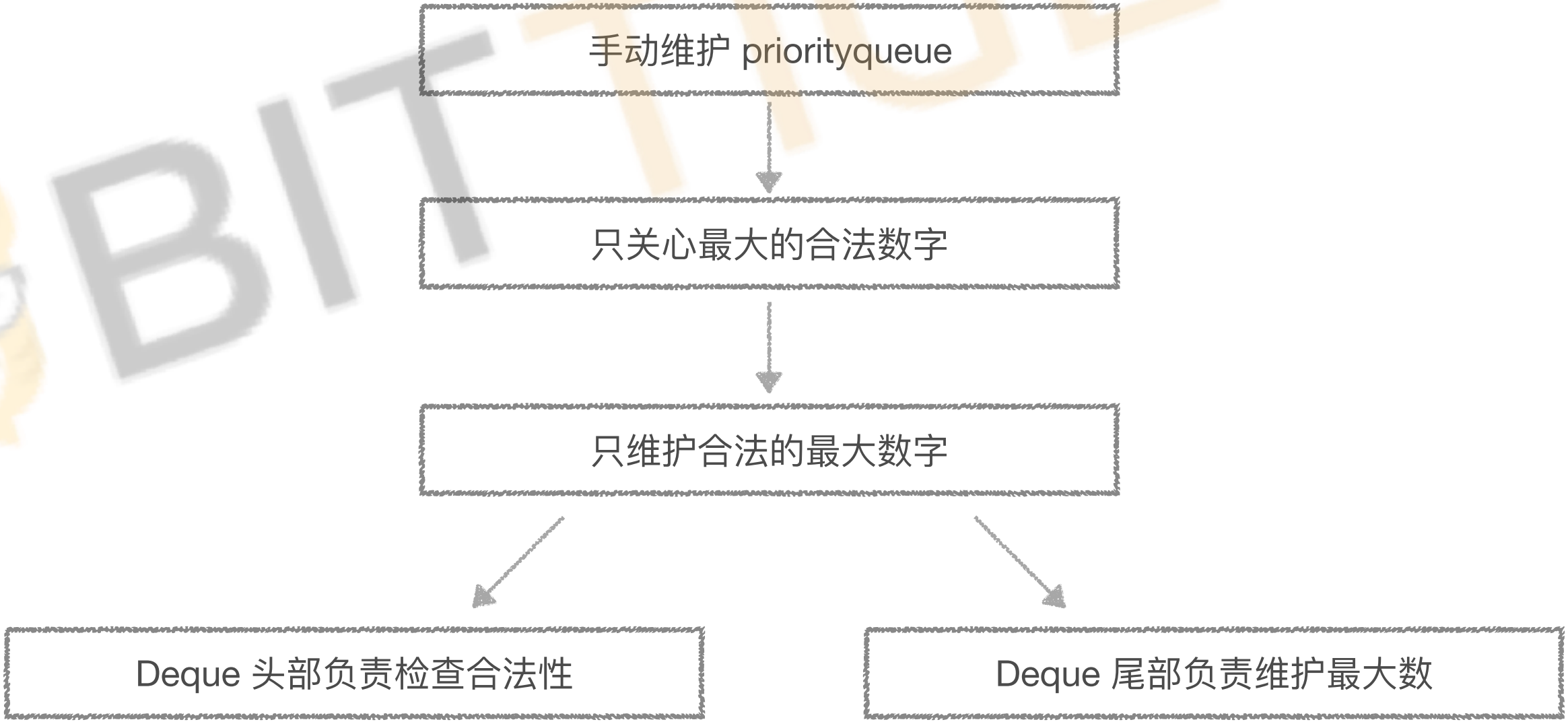
Given *nums* = `[1,3,-1,-3,5,3,6,7]`, and *k* = 3.

```
Window position                Max
---------------               -----
[1  3  -1] -3  5  3  6  7       3
 1 [3  -1  -3] 5  3  6  7       3
 1  3 [-1  -3  5] 3  6  7       5
 1  3  -1 [-3  5  3] 6  7       5
 1  3  -1  -3 [5  3  6] 7       6
 1  3  -1  -3  5 [3  6  7]      7
```

Therefore, return the max sliding window as `[3,3,5,5,6,7]`.

10 min

```
public int[] maxSlidingWindow(int[] nums, int k) {
}
```


手动维护 priorityqueue
只关心最大的合法数字
只维护合法的最大数字
Deque 头部负责检查合法性
Deque 尾部负责维护最大数

```java
public int[] maxSlidingWindow(int[] nums, int k) {
    if(nums == null || nums.length == 0){
        return new int[0];
    }
    int len = nums.length;
    int[] res = new int[len - k + 1];
    Deque<Integer> heap = new ArrayDeque<>();

    for(int i = 0; i < len; i++){
        // manually manipulate your heap
        if(!heap.isEmpty() && heap.peekFirst() == i - k){
            heap.removeFirst();
        }

        while(!heap.isEmpty() && nums[heap.peekLast()] < nums[i]){
            heap.removeLast();
        }

        heap.addLast(i);

        if(i - k + 1 >= 0){
            res[i - k + 1] = nums[heap.peekFirst()];
        }
    }

    return res;
}
```

移除 不在sliding window范围中的元素

移除 smaller 元素

42. Trapping Rain Water

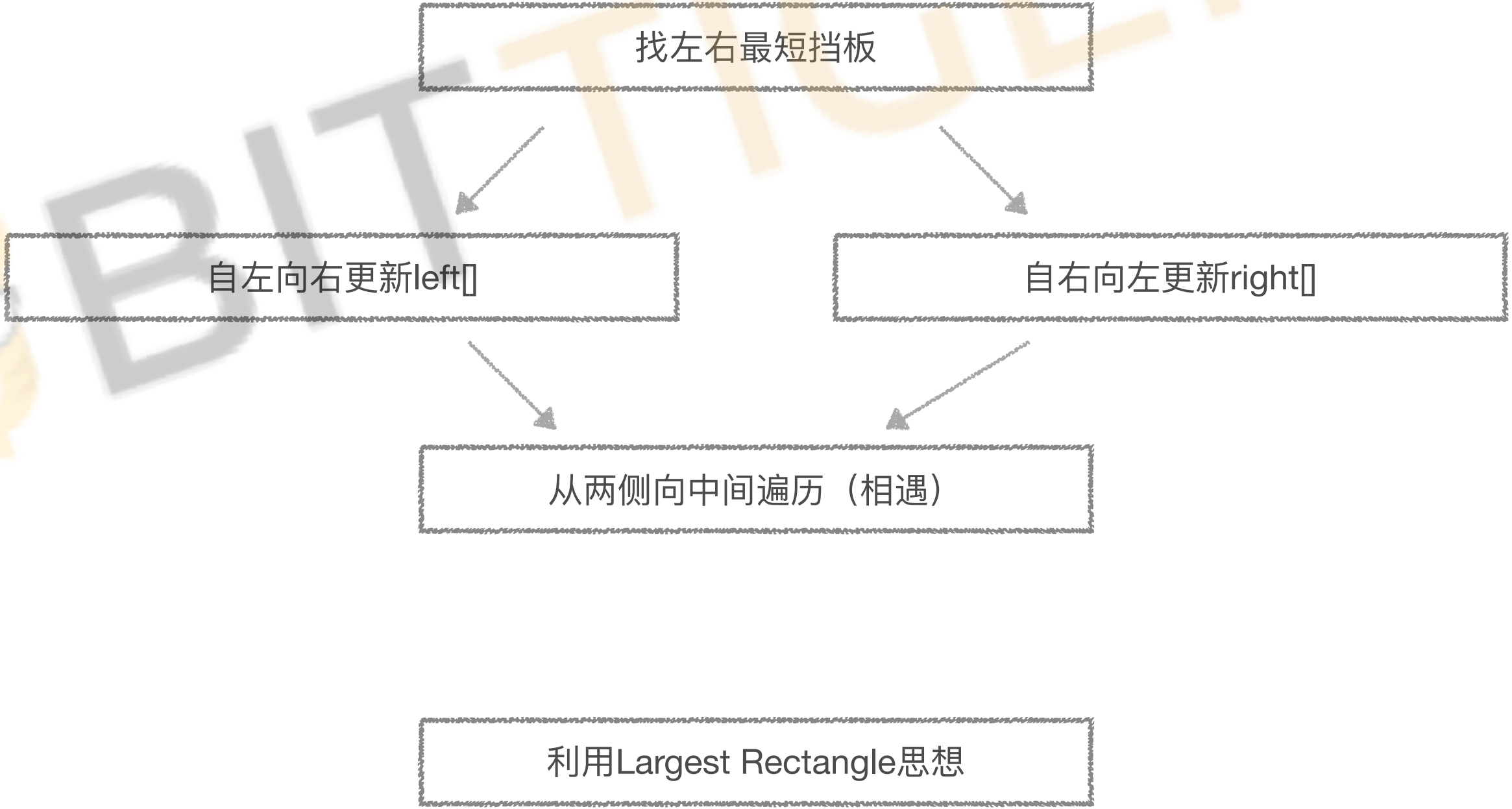
Given *n* non-negative integers representing an elevation map where the width of each bar is 1, compute how much water it is able to trap after raining.

For example,

Given `[0,1,0,2,1,0,1,3,2,1,2,1]`, return `6`.

10 min

```
public int trap(int[] height) {
}
```


找左右最短挡板
自左向右更新left[]
自右向左更新right[]
从两侧向中间遍历（相遇）
利用Largest Rectangle思想

```java
public int trap(int[] height) {
    if(height == null || height.length <= 1){
        return 0;
    }

    int left = 0;
    int right = height.length - 1;
    int maxLeft = 0;
    int maxRight = 0;
    int res = 0;

    while(left <= right){
        if(height[left] <= height[right]){
            if(height[left] >= maxLeft){
                maxLeft = height[left];
            }else{
                res += maxLeft - height[left];
            }

            left++;
        }else{
            if(height[right] >= maxRight){
                maxRight = height[right];
            }else{
                res += maxRight - height[right];
            }

            right--;
        }

    }

    return res;
}
```

判断左右短板

确认是否可以存水

```java
public int trapStack(int[] height) {
    if(height == null || height.length <= 1){
        return 0;
    }

    Deque<Integer> stack = new ArrayDeque<>();

    int res = 0;
    for(int i = 0; i < height.length; ){
        if(stack.isEmpty() || height[i] <= height[stack.peekFirst()]){
            stack.addFirst(i);
            i++;
        }else{
            // height[i] > height[stack.peekFirst()] start trapping previous water
            int curIndex = stack.removeFirst();
            if(stack.isEmpty()){
                // no left boundary
                continue;
            }
            int preIndex = stack.peekFirst();
            res += (Math.min(height[preIndex], height[i]) - height[curIndex]) * (i - preIndex - 1);
        }
    }

    return res;

}
```

维护降序stack

Homework

280. Wiggle Sort
324. Wiggle Sort II
456. 132 Pattern
25. Reverse Nodes in k-Group
442. Find All Duplicates in an Array
287. Find the Duplicate Number

Q & A

Thank you