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1. **First and Last Occurences:**

Given a sorted array arr with possibly some duplicates, the task is to find the first and last occurrences of an element x in the given array.

Note: If the number x is not found in the array then return both the indices as -1.

Examples:

Input: arr[] = [1, 3, 5, 5, 5, 5, 67, 123, 125], x = 5

Output: [2, 5]

Explanation: First occurrence of 5 is at index 2 and last occurrence of 5 is at index 5

Input: arr[] = [1, 3, 5, 5, 5, 5, 7, 123, 125], x = 7

Output: [6, 6]

Explanation: First and last occurrence of 7 is at index 6

Input: arr[] = [1, 2, 3], x = 4

Output: [-1, -1]

Explanation: No occurrence of 4 in the array, so, output is [-1, -1]

Constraints:

1 ≤ arr.size() ≤ 106

1 ≤ arr[i], x ≤ 109

**Program:**

class GFG {

ArrayList<Integer> find(int arr[], int x) {

ArrayList<Integer> c = new ArrayList<>();

for (int i = 0; i < arr.length; i++) {

if (arr[i] == x) {

c.add(i);

}

}

if (c.size() == 0) {

return new ArrayList<>(Arrays.asList(-1, -1));

}

if (c.size() > 1) {

return new ArrayList<>(Arrays.asList(c.get(0), c.get(c.size() - 1)));

} else {

return new ArrayList<>(Arrays.asList(c.get(0), c.get(0)));

}

}

}

1. **Wave Array:**

Given a sorted array arr[] of distinct integers. Sort the array into a wave-like array(In Place). In other words, arrange the elements into a sequence such that arr[1] >= arr[2] <= arr[3] >= arr[4] <= arr[5].....

If there are multiple solutions, find the lexicographically smallest one.

Note: The given array is sorted in ascending order, and you don't need to return anything to change the original array.

Examples:

Input: arr[] = [1, 2, 3, 4, 5]

Output: [2, 1, 4, 3, 5]

Explanation: Array elements after sorting it in the waveform are 2, 1, 4, 3, 5.

Input: arr[] = [2, 4, 7, 8, 9, 10]

Output: [4, 2, 8, 7, 10, 9]

Explanation: Array elements after sorting it in the waveform are 4, 2, 8, 7, 10, 9.

Input: arr[] = [1]

Output: [1]

Constraints:

1 ≤ arr.size ≤ 106

0 ≤ arr[i] ≤107

**Program:**

class Solution {

public static void convertToWave(int[] arr) {

int i=0,n=arr.length,temp;

while (i<n-1){

temp=arr[i];

arr[i]=arr[i+1];

arr[i+1]=temp;

i+=2;

}

}

}

1. **Remove Duplicates:**

Given a sorted array arr. Return the size of the modified array which contains only distinct elements.

Note:

1. Don't use set or HashMap to solve the problem.

2. You must return the modified array size only where distinct elements are present and modify the original array such that all the distinct elements come at the beginning of the original array.

Examples :

Input: arr = [2, 2, 2, 2, 2]

Output: [2]

Explanation: After removing all the duplicates only one instance of 2 will remain i.e. [2] so modified array will contains 2 at first position and you should return 1 after modifying the array, the driver code will print the modified array elements.

Input: arr = [1, 2, 4]

Output: [1, 2, 4]

Explation: As the array does not contain any duplicates so you should return 3.

Constraints:

1 ≤ arr.size() ≤ 105

1 ≤ ai ≤ 106

**Program:**

class Solution {

public int remove\_duplicate(List<Integer> arr) {

int i = 0, n = arr.size();

for (int j = 1; j < n; j++) {

if (!arr.get(j).equals(arr.get(i))) {

i++;

arr.set(i, arr.get(j));

}

}

return i + 1;

}

}

1. **Find Transition Point:**

Given a sorted array, arr[] containing only 0s and 1s, find the transition point, i.e., the first index where 1 was observed, and before that, only 0 was observed. If arr does not have any 1, return -1. If array does not have any 0, return 0.

Examples:

Input: arr[] = [0, 0, 0, 1, 1]

Output: 3

Explanation: index 3 is the transition point where 1 begins.

Input: arr[] = [0, 0, 0, 0]

Output: -1

Explanation: Since, there is no "1", the answer is -1.

Input: arr[] = [1, 1, 1]

Output: 0

Explanation: There are no 0s in the array, so the transition point is 0, indicating that the first index (which contains 1) is also the first position of the array.

Input: arr[] = [0, 1, 1]

Output: 1

Explanation: Index 1 is the transition point where 1 starts, and before it, only 0 was observed.

Constraints:

1 ≤ arr.size() ≤ 105

0 ≤ arr[i] ≤ 1

**Problem:**

class Solution {

int transitionPoint(int arr[]) {

int i=0;

while(i<arr.length){

if (arr[i]==1) return i;

i++;

}

return -1;

}

}

1. **Stock Buy and Sell:**

The cost of stock on each day is given in an array A[] of size N. Find all the segments of days on which you buy and sell the stock such that the sum of difference between sell and buy prices is maximized. Each segment consists of indexes of two elements, first is index of day on which you buy stock and second is index of day on which you sell stock.

Note: Since there can be multiple solutions, the driver code will print 1 if your answer is correct, otherwise, it will return 0. In case there's no profit the driver code will print the string "No Profit" for a correct solution.

Example 1:

Input:

N = 7

A[] = {100,180,260,310,40,535,695}

Output:

1

Explanation:

One possible solution is (0 3) (4 6)

We can buy stock on day 0,

and sell it on 3rd day, which will

give us maximum profit. Now, we buy

stock on day 4 and sell it on day 6.

Example 2:

Input:

N = 5

A[] = {4,2,2,2,4}

Output:

1

Explanation:

There are multiple possible solutions.

one of them is (3 4)

We can buy stock on day 3,

and sell it on 4th day, which will

give us maximum profit.

Your Task:

The task is to complete the function stockBuySell() which takes an array of A[] and N as input parameters and finds the days of buying and selling stock. The function must return a 2D list of integers containing all the buy-sell pairs i.e. the first value of the pair will represent the day on which you buy the stock and the second value represent the day on which you sell that stock. If there is No Profit, return an empty list.

Expected Time Complexity: O(N)

Expected Auxiliary Space: O(N)

Constraints:

2 ≤ N ≤ 106

0 ≤ A[i] ≤ 106

**Program:**

class Solution{

//Function to find the days of buying and selling stock for max profit.

ArrayList<ArrayList<Integer> > stockBuySell(int A[], int n) {

ArrayList<ArrayList<Integer>> res = new ArrayList<>();

for (int i = 0; i < n - 1; i++) {

if (A[i + 1] - A[i] > 0) {

ArrayList<Integer> a = new ArrayList<>();

a.add(i);

a.add(i + 1);

res.add(a);

}

}

return res;

}

}

1. **First Repeating Element:**

Given an array arr[], find the first repeating element. The element should occur more than once and the index of its first occurrence should be the smallest.

Note:- The position you return should be according to 1-based indexing.

Examples:

Input: arr[] = [1, 5, 3, 4, 3, 5, 6]

Output: 2

Explanation: 5 appears twice and its first appearance is at index 2 which is less than 3 whose first the occurring index is 3.

Input: arr[] = [1, 2, 3, 4]

Output: -1

Explanation: All elements appear only once so answer is -1.

Constraints:

1 <= arr.size <= 106

0 <= arr[i]<= 106

**Program:**

class Solution {

// Function to return the position of the first repeating element.

public static int firstRepeated(int[] arr) {

HashSet<Integer> seen = new HashSet<>();

int ptr = -1,n=arr.length;

for (int i = n - 1; i >= 0; i--) {

if (seen.contains(arr[i])) {

ptr = i;

} else {

seen.add(arr[i]);

}

}

return ptr == -1 ? -1 : ptr + 1;

}

}

1. **Maximum Index:**

Given an array arr of positive integers. The task is to return the maximum of j - i subjected to the constraint of arr[i] < arr[j] and i < j.

Examples:

Input: arr[] = [1, 10]

Output: 1

Explanation: arr[0] < arr[1] so (j-i) is 1-0 = 1.

Input: arr[] = [34, 8, 10, 3, 2, 80, 30, 33, 1]

Output: 6

Explanation: In the given array arr[1] < arr[7] satisfying the required condition(arr[i] < arr[j]) thus giving the maximum difference of j - i which is 6(7-1).

Expected Time Complexity: O(n)

Expected Auxiliary Space: O(n)

Constraints:

1 ≤ arr.size ≤ 106

0 ≤ arr[i] ≤ 109

**Program:**

class Solution {

public int maxIndexDiff(int[] arr) {

Stack<Integer> s = new Stack<>();

int c = 0, n = arr.length;

for (int i = n - 1; i >= 0; i--) {

if (s.isEmpty() || arr[s.peek()] < arr[i]) {

s.push(i);

}

}

for (int i = 0; i < n; i++) {

while (!s.isEmpty() && arr[i] <= arr[s.peek()]) {

c = Math.max(c, s.pop() - i);

}

}

return c;

}

}