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DSA-PRACTICE Day-5

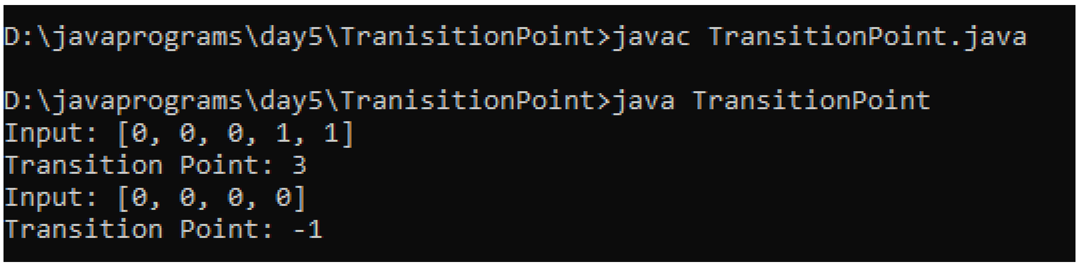
1. Find Transition Point

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.
CODE:

```
class Solution {
    public static int transitionPoint(int arr[]) {
        int n = arr.length;
        if (arr[0] == 1) {
            return 0;
        }
        int lb = 0, ub = n - 1;

        while (lb <= ub) {
            int mid = (lb + ub) / 2;

            if (arr[mid] == 0) lb = mid + 1;
            else if (arr[mid] == 1) {
                if (mid == 0 || arr[mid - 1] == 0) return mid;
                ub = mid - 1;
            }
        }
        return -1;
    }

    public static void main(String[] args) {
        int[] arr1 = {0, 0, 0, 1, 1};
        int[] arr2 = {0, 0, 0, 0};

        System.out.println("Input: " + java.util.Arrays.toString(arr1));
        System.out.println("Transition Point: " + transitionPoint(arr1));

        System.out.println("Input: " + java.util.Arrays.toString(arr2));
        System.out.println("Transition Point: " + transitionPoint(arr2));
    }
}
```

output: 

```
D:\javaprograms\day5\TranisitionPoint>javac TransitionPoint.java

D:\javaprograms\day5\TranisitionPoint>java TransitionPoint
Input: [0, 0, 0, 1, 1]
Transition Point: 3
Input: [0, 0, 0, 0]
Transition Point: -1
```

TIME COMPLEXITY:O(log n)

2. 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]

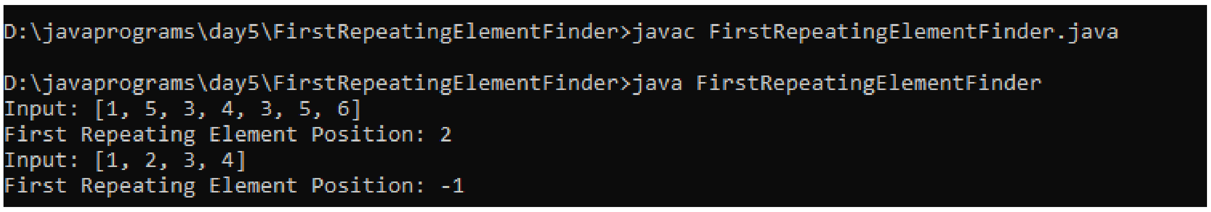
Output: -1

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

CODE:

```
import java.util.HashMap;

class FirstRepeatingElementFinder {
    public static int firstRepeated(int[] arr) {
        HashMap<Integer, Integer> ans = new HashMap<>();
        int minIndex = Integer.MAX_VALUE;

        for (int i = 0; i < arr.length; i++) {
            if (ans.containsKey(arr[i])) {
                minIndex = Math.min(minIndex, ans.get(arr[i]));
            } else {
                ans.put(arr[i], i + 1);
            }
        }

        return (minIndex == Integer.MAX_VALUE) ? -1 : minIndex;
    }

    public static void main(String[] args) {
        int[] arr1 = {1, 5, 3, 4, 3, 5, 6};
        int[] arr2 = {1, 2, 3, 4};

        System.out.println("Input: " + java.util.Arrays.toString(arr1));
        System.out.println("First Repeating Element Position: " + firstRepeated(arr1));

        System.out.println("Input: " + java.util.Arrays.toString(arr2));
        System.out.println("First Repeating Element Position: " + firstRepeated(arr2));
    }
}
```

OUTPUT:



```
D:\javaprograms\day5\FirstRepeatingElementFinder>javac FirstRepeatingElementFinder.java

D:\javaprograms\day5\FirstRepeatingElementFinder>java FirstRepeatingElementFinder
Input: [1, 5, 3, 4, 3, 5, 6]
First Repeating Element Position: 2
Input: [1, 2, 3, 4]
First Repeating Element Position: -1
```

TIME COMPLEXITY:O(n)

3. Remove Duplicates Sorted Array

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.

CODE: import java.util.ArrayList;

```
import java.util.Arrays;


class DuplicateRemover {

    public int removeDuplicates(ArrayList<Integer> nums) {

        if (nums.size() == 0) return 0;
        int j = 1;
        for (int i = 1; i < nums.size(); i++) {
            if (!nums.get(i).equals(nums.get(i - 1))) {
                nums.set(j, nums.get(i));
                j++;
            }
        }

        while (nums.size() > j) {
            nums.remove(nums.size() - 1);
        }

        return j;
    }

    public static void main(String[] args) {
        DuplicateRemover remover = new DuplicateRemover();

        ArrayList<Integer> arr1 = new ArrayList<>(Arrays.asList(2, 2, 2, 2, 2));
        int newSize1 = remover.removeDuplicates(arr1);
        System.out.println("Output Array: " + arr1.subList(0, newSize1));
        System.out.println("Returned Size: " + newSize1);

        ArrayList<Integer> arr2 = new ArrayList<>(Arrays.asList(1, 2, 4));
        int newSize2 = remover.removeDuplicates(arr2);
        System.out.println("Output Array: " + arr2.subList(0, newSize2));
        System.out.println("Returned Size: " + newSize2);
    }
}
```

TIME COMPLEXITY:O(N)

4.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.

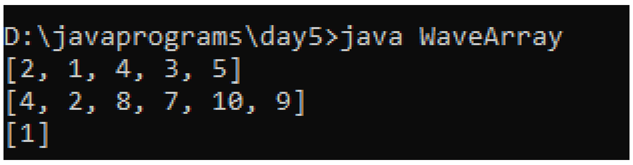
Examples:

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]
CODE:

```
import java.util.Arrays;


class WaveArraySorter {
    public static void waveSort(int[] arr) {
        for (int i = 1; i < arr.length; i += 2) {
            int temp = arr[i];
            arr[i] = arr[i - 1];
            arr[i - 1] = temp;
        }
    }

    public static void main(String[] args) {
        int[] arr1 = {1, 2, 3, 4, 5};
        waveSort(arr1);
        System.out.println(Arrays.toString(arr1)); // Output: [2, 1, 4, 3, 5]

        int[] arr2 = {2, 4, 7, 8, 9, 10};
        waveSort(arr2);
        System.out.println(Arrays.toString(arr2)); // Output: [4, 2, 8, 7, 10, 9]

        int[] arr3 = {1};
        waveSort(arr3);
        System.out.println(Arrays.toString(arr3)); // Output: [1]
    }
}
```

OUTPUT:



```
D:\javaprograms\day5>java WaveArray
[2, 1, 4, 3, 5]
[4, 2, 8, 7, 10, 9]
[1]
```

TIME COMPLEXITY:O(N)