Experiment5

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Subject Name: Advance Programming Lab -2 **Subject Code: 22CSP-351**

1. Aim:

Given an array nums with n objects colored red, white, or blue, sort them in-place so that objects of the same color are adjacent, with the colors in the order red, white, and blue. We will usethe integers 0, 1, and 2 to represent the color red, white, and blue, respectively. You must solve this problem without using the library's sort function.

Example1:

Input:nums=[2,0,2,1,1,0]Output:[0,0,1,1,2,2]

Example2:

Input:nums=[2,0,1]Output:[0,1,2]

Link:-

2. https://leetcode.com/problems/sort-colors/submissions/1561198765/

3. Objective:

The task is to sort an array representing colored objects (red, white, and blue) in-place. These colors are represented by integers 0, 1, and 2, respectively. The goal is to arrange the array such that elements of the same color are grouped together and the colors appear in the order red, white, then blue. A key constraint is to achieve this sorting without using any built-in library sorting functions, focusing on a manual sorting approach. The in-place requirement means modifying the original array directly, without creating a new one. The solution should be efficient and adhere to the specified color order

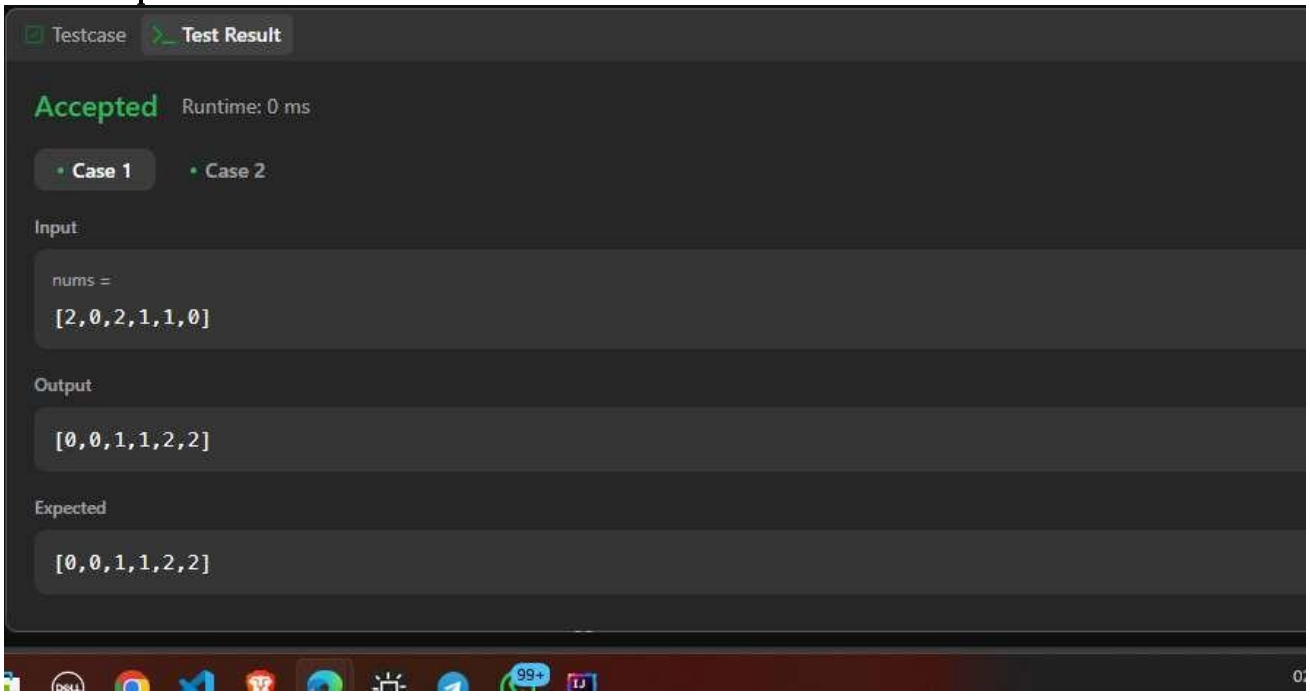
4. Implementation/Code:

```
classSolution{
  publicvoidsortColors(int[]nums){ int
    red = 0;
      intwhite=0; int
      blue = 0;
```

```
for(intnum:nums){ if
    (num == 0) {
        red++;
    }elseif(num==1){ white++;
    }else{
        blue++;
```

```
                }
            }
            intindex=0;
            for(inti=0;i<red;i++){
                nums[index++] = 0;
            }
            for(inti=0;i<white;i++){
                nums[index++] = 1;
            }
            for(inti=0;i<blue;i++){
                nums[index++] = 2;
            }
        }
    }
```

Output:-



```
Accepted   Runtime: 0 ms

Input
nums =
[2,0,2,1,1,0]

Output
[0,0,1,1,2,2]

Expected
[0,0,1,1,2,2]
```

5. Learningoutcomes:

- Understandingin-placealgorithms.
- Proficiency inarraymanipulation.
- Abilitytoimplementsortinglogicwithoutlibraryfunctions.
- Knowledgeofthe DutchNationalFlagalgorithm(orsimilarpartitioningtechniques).
- Analyzingspaceandtimecomplexityforsortingalgorithms.

1. **Aim:**

Given an integer array nums and an integer k, return the kth largest element in the array. Note that it is the kth largest element in the sorted order, not the kth distinct element. Can you solve it without sorting?

Example1:

Input:nums=[3,2,1,5,6,4],k=2Output:5

Example2:

Input: nums=[3,2,3,1,2,4,5,5,6], k =4 Output: 4

Link:-

https://leetcode.com/problems/kth-largest-element-in-an-array/submissions/1561201419/

2. **Objective:**

The objective is to efficiently identify the kth largest element within a given integer array. The target element is determined by its position in the sorted order of the array, not by its uniqueness. The challenge lies in achieving this without resorting to a full sorting of the array, implying theneed for amore optimized approach. Efficiency is key,especially consideringthe potential size of the input array. The goal is to return the value of the kth largest element.

3. **Implementation/Code:**

```
classSolution{
    public int findKthLargest(int[] nums, int k)
        {returnquickSelect(nums,0,nums.length -1, k);
    }

    private int quickSelect(int[]nums, int left, int right, int k) {
        Random random = new Random();
        int pivotIndex =left +random.nextInt(right - left +1); pivotIndex
        = partition(nums, left, right, pivotIndex);

        if(k==nums.length-pivotIndex){ return
            nums[pivotIndex];
        } elseif(k<nums.length-pivotIndex){
            returnquickSelect(nums,pivotIndex+1,right,k);
        }else{
            returnquickSelect(nums,left,pivotIndex-1,k);
        }
    }
    private int partition(int[] nums, int left, int right,int pivotIndex) {
        int pivotValue = nums[pivotIndex];
        swap(nums,pivotIndex,right);
        int storeIndex = left;

        for(inti =left;i<right;i++){
```

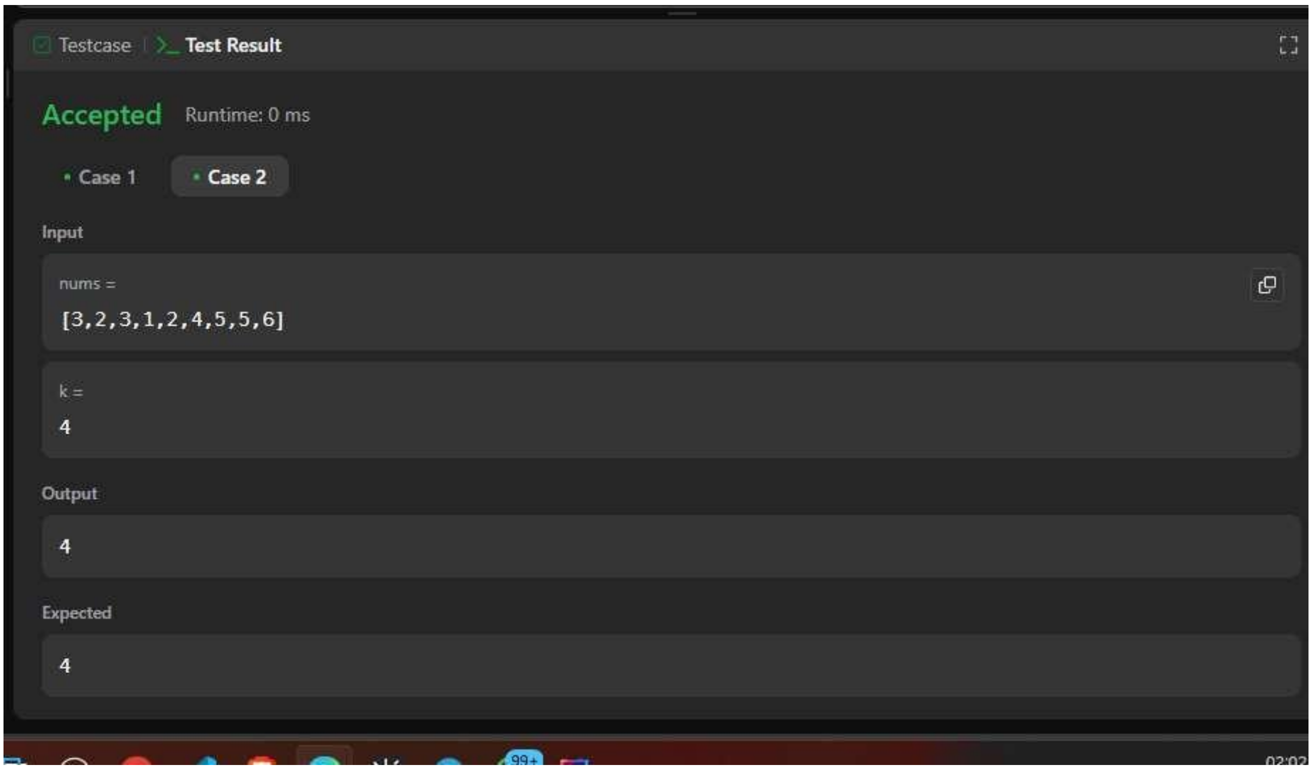
```
if (nums[i] < pivotValue) {
    swap(nums,i,storeIndex);
    storeIndex++;
```

```
            }
        }
        swap(nums,storeIndex,right);
        return storeIndex;
    }

    privatevoidswap(int[]nums,int i, intj){ int
        temp = nums[i];
        nums[i]=nums[j];
        nums[j] = temp;

    }
  }
```

Output:-



```
Accepted   Runtime: 0 ms

Case 1   Case 2

Input
nums =
[3,2,3,1,2,4,5,5,6]
k =
4

Output
4

Expected
4
```

6. Learningoutcomes:

- Understandingselectionalgorithms(e.g.,Quickselect).
- Knowledgeofpartitioningtechniques.
- Abilitytoanalyze theaverageandworst-casetime complexityofselectionalgorithms.
- UnderstandingtheimportanceofpivotselectioninQuickselect.