

## CS702 – Computing Lab

### Assignment 3

**Note:** Submit your assignment in a LaTeX file, containing algorithm/pseudocode, coding(c/c++), and test cases (table format).

#### Question 1:

Given an array `nums` containing  $n$  distinct numbers in the range  $[0, n]$ , return the only number in the range that is missing from the array.

Follow up: Can you find the missing number without sorting the array?

Sample Test Cases:

1. Input: `nums = [0,1]`  
Output: 2
2. Input: `nums = [9,6,4,2,3,5,7,0,1]`  
Output: 8
3. Input: `nums = [1,2,3,4,5]`  
Output: 0

#### Question 2:

You are given two arrays, `arr1` and `arr2`. The elements of `arr2` are distinct, and all elements in `arr2` are also in `arr1`.

Sort the elements of `arr1` such that the relative ordering of items in `arr1` is the same as in `arr2`. Elements that do not appear in `arr2` should be placed at the end of `arr1` in ascending order. Return the sorted `arr1`.

Sample Test Cases:

1. Input:  
  
`arr1 = [10, 20, 30, 40, 20, 10, 50]`  
  
`arr2 = [20, 10]`  
  
Output:  
  
`[20, 20, 10, 10, 30, 40, 50]`
2. Input:  
  
`arr1 = [4, 3, 9, 8, 7, 3, 1]`  
  
`arr2 = [3, 9, 1]`  
  
Output:

[3, 3, 9, 1, 4, 7, 8]

3. Input:

arr1=[28,6,22,8,44,17]

arr2 = [22,28,8,6]

Output:

[22,28,8,6,17,44]

### Question 3:

You are given an integer array nums and an integer k. Your task is to return the k most frequent elements from the array.

The answer can be returned in any order. If multiple elements have the same frequency, any of them can be chosen.

Sample Test Cases:

1. Input:

nums = [7,7,8,8,9,9,10]

k = 3

Output:

[7,8,9]

2. Input:

nums = [5]

k = 1

Output:

[5]

3. Input:

nums = [4,4,4,6,6,2,2,2,2]

k = 1

Output:

[2]

**Question 4:**

Given an integer array `nums`, return the maximum difference between two successive elements in its sorted form. If the array contains fewer than two elements, return 0.

You must write an algorithm that runs in linear time and uses linear extra space.

Sample Test Cases:

1. Input: `nums = [3,6,9,1]`  
Output: 3
2. Input: `nums = [4,2,1,3]`  
Output: 1
3. Input: `nums = [7,7,7,7]`  
Output: 0

**Question 5:**

You are given an unsorted array of integers. Rearrange the numbers so they follow this pattern:

$$\text{nums}[0] \leq \text{nums}[1] \geq \text{nums}[2] \leq \text{nums}[3] \geq \text{nums}[4] \dots$$

In other words, every even index is less than or equal to the next element, and every odd index is greater than or equal to the next element.

You must do this in-place (rearrange the array without using `sort()`).

Sample Test Cases:

1. Input: `nums = [3,5,2,1,6,4]`  
Output: `[3,5,1,6,2,4]`
2. Input: `nums = [6,5,4,3,2,1]`  
Output: `[5,6,3,4,1,2]`
3. Input: `nums = [10,90,49,2,1,5,23]`  
Output: `[10,90,2,49,1,23,5]`