# Minimum operations to make all elements equal

Given an array consisting of positive integers, return the minimum number of operations to make all the elements of the array equal. The operations can be addition, multiplication, division, or subtraction.

Brute-Force

To find the element with the highest frequency, we will run two loops. The outer loop picks all the elements one by one and the inner loop finds the frequency of the picked element and compares it with the element with the highest frequency so far. If it is greater, it replaces to be the highest frequent element. After this, we will simply return the "number of elements  - frequency of the most frequent element".

Time complexity: O(n2)

Space complexity: O(1)

Better Approach (Hashing)

Maintain a map that consists of the frequency of all the elements in the array. The highest frequent element in the hash table will be our target element and thus, our answer will be "number of elements - frequency of the target element".

Time complexity: O(n)

Space complexity: O(n)

# Check if the given array contains duplicate elements within k distance

Given an unsorted array that may contain duplicates. Also given a number k which is smaller than the size of the array, returns true if the array contains duplicates within k distance.

Example-1:

Input: k = 3, arr[] = {1, 2, 3, 4, 1, 2, 3, 4}

Output: false

All duplicates are more than k(3) distance away.

1...1(has a distance of 4)

2...2(has a distance of 4)

3...3 and 4...4 are similar

Brute-Force

A Naive solution is to run two loops. The outer loop picks every element ‘arr[i]’ as a starting element, and the inner loop compares all elements which are within k distance of ‘arr[i]’.

Time complexity: O(k\*n)

Space complexity: O(1)

Better Approach (Hashing)

If the array element is already present in our map then get its position from a map and calculate the difference between the current index and the position that we have fetched from the map.

If the difference is greater than k then update the position of the current element in the map

If the difference is less than k then simply return true.

# Max distance between same elements

Given an array with repeated elements, the task is to find the maximum distance between two occurrences of an element.

Input : arr[] = {3, 2, 1, 2, 1, 4, 5, 8, 6, 7, 4, 2}

Output: 10

// maximum distance for 2 is 11-1 = 10

// maximum distance for 1 is 4-2 = 2

// maximum distance for 4 is 10-5 = 5

Brute-Force

A simple solution for this problem is to, one by one, pick each element from the array and find its first and last occurrence in the array and take the difference between the first and last occurrence for maximum distance.

Time complexity: O(n^2)

Space complexity: O(1)

Better Approach (Hashing)

The idea is to traverse the input array and store the index of the first occurrence in a hash map. For every other occurrence, find the difference between the index and the first index stored in the hash map. If the difference is more than the result so far, then update the result.

Time complexity : O(n)

Space complexity: O(n)

# Count pairs with given sum

Given an array of N integers, and an integer K, find the number of pairs of elements in the array whose sum is equal to K.

Input:

N = 4, K = 6

arr[] = {1, 5, 7, 1}

Output: 2

Explanation:

arr[0] + arr[1] = 1 + 5 = 6

and arr[1] + arr[3] = 5 + 1 = 6.

Input:

N = 4, K = 2

arr[] = {1, 1, 1, 1}

Output: 6

Explanation:

Each 1 will produce sum 2 with any 1.

Brute-Force

A simple solution is to traverse each element and check if there’s another number in the array which can be added to it to give sum.

This can be achieved by nested loops.

Time Complexity: O(n2), traversing the array for each element

Auxiliary Space: O(1)

Better Approach (Hashing)

Check the frequency of sum – arr[i] in the arr , by using a hash map.

Time complexity : O(n)

Space complexity: O(n)

# First Unique Character in a String

Given a string s, find the first non-repeating character in it and return its index. If it does not exist, return -1.

Input: s = "loveleetcode"

Output: 2

Brute-Force

Idea is to loop over the string and for every character check the occurrence of the same character in the string. If the count of its occurrence is 1 then return that character. Otherwise, search for the remaining characters.

Time Complexity: O(N2), Traverse over the string for every character in the string of size N.

Auxiliary Space: O(1)

Better Approach (Hashing)

Idea is to find the frequency of all characters in the string and check which character has a unit frequency.

Time Complexity: O(N) + O(N) ~ O(N)

Auxiliary Space: O(26) , At most the hashmap keys will be covered with this much space only.

# Find Common Characters

Given a string array words, return an array of all characters that show up in all strings within the words (including duplicates). You may return the answer in any order.

Example :

Input: words = ["bella","label","roller"]

Output: ["e","l","l"]

Better Approach (Hashing)

This solution uses an array count of size 26 to keep track of the minimum count of each character that appears in all the words. It initializes the count array with a large value and updates it by finding the minimum count for each character in each word.

Time Complexity: O(26 x N )

Space Complexity : O(len of min word in worst case)

# Count Number of Pairs With Absolute Difference K

Given an integer array nums and an integer k, return the number of pairs (i, j) where i < j such that |nums[i] - nums[j]| == k.

The value of |x| is defined as:

x if x >= 0.

-x if x < 0.

Brute-Force

Explore each pair using a nested for loop.

Time Complexity: O(n2), traversing the array for each element

Auxiliary Space: O(1)

Better Approach (Hashing)

Iterate through each number num in the input array nums.

If num - k or num + k exists in the frequency\_map, increment the count by the frequency of num - k or num + k in the frequency\_map.

Increment the frequency of num in the frequency\_map.

Time complexity : O(n)

Space complexity: O(n)

Question : Why do we have to make the hash map on the go and not before hand ?

Answer : If we make that hash map before hand , we will be taking the same pair twice , like (i , j) and (j , i) ,so we need to make the hashmap on the go only which ensures only one pair is counted.

# Subarray Sum Equals K

Given an unsorted array of integers, find the number of subarrays having a sum exactly equal to a given number k.

Brute-Force

Explore each pair subarray using a nested for loop.

Time Complexity: O(n2), traversing the array for each element

Auxiliary Space: O(1)

Better Approach (Hashing)

While traversing the array, storing sum so far in currsum.

Also, maintain the count of different values of currsum in a map.

If the value of currsum is equal to the desired sum at any instance increment count of subarrays by one.

The value of currsum exceeds (in case of positive nums , but we should generalize this condition ) the desired sum by currsum – sum. If this value is removed from currsum then the desired sum can be obtained.

From the map, find the number of subarrays previously found having sum equal to currsum-sum.

Excluding all those subarrays from the current subarray, gives new subarrays having the desired sum.

Note that when currsum is equal to the desired sum then also check the number of subarrays previously having a sum equal to 0.

Time complexity : O(n)

Space complexity: O(n)