2918. Minimum Equal Sum of Two Arrays After Replacing Zeros

is not possible to make the sums of both arrays equal by replacing zeros, the function should return -1.

Medium

In this problem, we are provided with two arrays, nums1 and nums2, each containing positive integers. However, both arrays may

Problem Description

contain zeros, and we need to find a way to replace these zeros with positive integers. Our goal is to ensure that after the replacements, the sum of the integers in both arrays is the same.

The question then is: What is the minimum equal sum we can achieve after replacing all zeros with strictly positive integers? If it

It's a problem that demands a careful examination of the sums of arrays and the zeros they contain to find a method to balance the sums with minimum changes.

Intuition

To approach the problem, we first handle the zeros in a straightforward way. We consider replacing each zero with 1, as this is the

smallest strictly positive integer. This gives us a baseline sum for each array.

Let s1 and s2 be the sums of nums1 and nums2 respectively when each zero is treated as 1. Based on these sums, we can reason about the possible scenarios:

1. If s1 equals s2, we already have equality and do not need to replace any zeros with larger numbers, so the baseline sum is the answer.

2. If s1 is less than s2, and there are zeros in nums1, we can increase the sum of nums1 by replacing zeros with numbers larger than 1 to match

s2. In this case, since s2 is larger, it is our target, and we return s2 because it represents the minimum equal sum we can achieve.

3. Conversely, if s1 is more than s2, we swap the roles of nums1 and nums2 to apply the above reasoning.

4. If s1 is less than s2, but nums1 has no zeros, we cannot increase the sum of nums1 to match s2. Thus, it is impossible to make the sums equal and we return -1.

Solution Approach

The solution approach is to first calculate the sums of the arrays while treating all zeros as ones. This calculation is

straightforward and can be done using the built-in sum function in Python, along with the count method to account for the zeros.

Once the sums are calculated, we compare them to decide the next steps:

else:

return -1

s1 = sum(nums1) + nums1.count(0)

s2 = sum(nums2) + nums2.count(0)

• If s1 is greater than s2, we have a helper function, self.minSum, that we call with the arrays swapped. This is an example of recursion that helps us reduce the problem to a single direction where s1 is less than or equal to s2, ensuring a more straightforward decision process:

if s1 > s2:

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return self.minSum(nums2, nums1)

• If the sums are already equal (s1 == s2), we have achieved the goal of equal sums with minimum effort, merely by treating zeros as ones. The
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if s1 == s2:
 return s1

Consider the arrays nums1 = [0, 2, 3] and nums2 = [1, 0, 4, 0].

 \circ For nums1: The sum is 1 (replacing 0) + 2 + 3 = 6.

to match the sum s2. Indeed, nums1 has one zero.

We start by treating all zeros in nums1 and nums2 as ones and calculate their sums.

baseline sum s1 (or s2, since they are equal now) is the minimum sum we can achieve, so we return it:

The following code calculates these sums for nums1 and nums2:

match the sum s2. Therefore, we return s2 which is the target sum:
if nums1.count(0) != 0:
 return s2

• In the case that s1 is less than s2, we have two scenarios. If there are zeros in nums1, we can replace them with numbers greater than one to

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• Finally, if there are no zeros in nums1, it implies we cannot adjust the sum of nums1 to match s2, making it impossible for both array sums to be equal, and we return -1:
```

Example Walkthrough

logic, along with recursion, forms the core of this solution, eliminating the need for complex data structures or patterns.

By considering these conditions and applying the recursive step, the algorithm ensures minimum modifications are made to

achieve equal sums, or it correctly identifies when the task is impossible. The use of simple built-in functions and conditional

For nums2: The sum is 1 + 1 (replacing 0) + 4 + 1 (replacing 0) = 7.
s1 becomes 6 and s2 becomes 7.
We compare s1 and s2. Since s1 is less than s2, we proceed without swapping the arrays.
Because s1 (sum of nums1) is less than s2 (sum of nums2), we check if there are zeros present in nums1 that we can replace

We can replace the zero in nums1 with a positive integer that will raise the sum of nums1 to match s2. Since s2 is 7, and the

current sum of nums1 is 6, we can replace the zero with any number greater than 1 to meet or exceed the sum of nums2. For

minimal increment, we can choose to replace zero with the smallest number greater than 1, which is 2. It is now nums1 = [2, 1]

Since we can match the sums by replacing zeros with strictly positive integers, we return \$2. Here, the minimum equal sum

According to this logic, if nums1 had no zeros but still had a smaller sum than nums2, we would return -1, indicating it's not

2, 3].

Python

Java

class Solution:

possible to match the sums.

• Step 1 corresponds to the initial calculations:

equal sum we can achieve after replacements.

we achieve is 7.

Now, let's break down the steps according to the code snippets provided in the solution approach:

After replacement, the sum of nums1 is now 2 + 2 + 3 = 7, which matches s2.

• Since s1 < s2, we do not swap nums1 and nums2, and the first recursive call is skipped.

• Checking s1 == s2 would skip the second condition in this case since they are not equal.

• There is no need to execute the last condition else: return -1 since we did not return -1.

with strictly positive integers or determining when it's not possible to match the sums.

Otherwise, return the sum of the second list as it is the smaller sum

* It returns -1 if it is impossible to make both sums equal without the use of zeros.

def minSum(self, nums1: List[int], nums2: List[int]) -> int:

sum nums1 = sum(nums1) + nums1.count(0)

sum_nums2 = sum(nums2) + nums2.count(0)

return self.minSum(nums2, nums1)

* @param nums1 the first array of integers

* @param nums2 the second array of integers

public long minSum(int[] nums1, int[] nums2) {

// Iterate over the second array

return minSum(nums2, nums1);

for (int value : nums2) {

if (sum1 > sum2) {

if (sum1 == sum2) {

return sum1;

return -1 if nums1.count(0) == 0 else sum_nums2

* that none of the elements in the arrays are less than one.

* @return the minimum sum possible or -1 if it can't be done

long sum1 = 0; // Initialize sum for the first array

hasZero |= value == 0; // Set the flag if zero is found

// If the sums are equal, return the sum of the first array

if sum nums1 > sum nums2:

if sum nums1 == sum nums2:

return sum_nums1

- s1 = sum(nums1) + nums1.count(0) # s1 = 6 s2 = sum(nums2) + nums2.count(0) # s2 = 7
- if nums1.count(0) != 0:
 return s2 # returns 7

The given example demonstrates how the solution approach is applied to find the minimum equal sum after replacing all zeros

• In the third condition, we evaluate if nums1.count(0) != 0:. Because nums1 contains a zero, we return s2 (7), which represents the minimum

Solution Implementation

Calculate the sum of elements in each list. The sum includes an extra 1 for each zero found in the list

If the sum of the first list is greater than the second, recursively call minSum with reversed lists

If the sums are equal, return the sum (since that is the minimum sum after replacing zeros)

If there are no zeros in the first list, it's not possible to make the sums equal, return -1

sum1 += Math.max(value, 1); // Ensure that each value contributes at least 1 to the sum

sum2 += Math.max(value, 1); // Ensure that each value contributes at least 1 to the sum

// If the sum of the first array is greater, call the function again with reversed parameters

class Solution {
 /**
 * Computes the minimum sum possible between two given arrays after making sure

```
long sum2 = 0; // Initialize sum for the second array
boolean hasZero = false; // Flag to check for presence of zero in nums1

// Iterate over the first array
for (int value : nums1) {
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// If there is a zero in the first array and the sums are not equal, returning the sum of the
        // second array is valid; otherwise, return -1 as it is impossible to make sums equal.
        return hasZero ? sum2 : −1;
C++
class Solution {
public:
    // Function to calculate the minimum sum of modified arrays such that their sums are equal
    long long minSum(vector<int>& nums1, vector<int>& nums2) {
        long long sumNums1 = 0; // Sum of elements in nums1
        long long sumNums2 = 0; // Sum of elements in nums2
        bool hasZero = false; // Flag to check if nums1 contains a zero
        // Calculate the sum for nums1, replacing zeros with ones (as min(x, 1) ensures)
        for (int num : nums1) {
            hasZero |= num == 0; // Update the flag if there's a zero in the array
            sumNums1 += std::max(num, 1); // Add the maximum of the number and 1 to the sum
        // Calculate the sum for nums2 in a similar way, replacing zeros with ones
        for (int num : nums2) {
            sumNums2 += std::max(num, 1);
        // If sum of nums1 is greater than sum of nums2, we should calculate minSum in the opposite order
        if (sumNums1 > sumNums2) {
            return minSum(nums2, nums1);
        // If sums are equal, return the sum of nums1 (which is now confirmed to be the smaller sum)
        if (sumNums1 == sumNums2) {
            return sumNums1;
        // If there's a zero in nums1 and the sums are not equal, it's impossible to equalize the sums
        // Since we can't lower the sum of the other array, hence we return -1.
        // If there is no zero, we can return the sum of the second array since it's larger.
        return hasZero ? sumNums2 : -1;
};
TypeScript
 * Calculates the minimal sum of two arrays after ensuring that all elements are at least 1.
 * If an array contains a zero, it is possible to swap arrays to minimize the sum.
 * @param {number[]} nums1 First array of numbers.
 * @param {number[]} nums2 Second array of numbers.
```

* @returns {number} The minimal sum or -1 if it's not possible to equalize sums with the given conditions.

// If contains a zero, we can swap to possibly minimize sum, otherwise return -1 as it's not possible

function minSum(nums1: number[], nums2: number[]): number {

// Calculate sum for nums1 and flag if zero is found

```
// Recursive call to swap nums1 and nums2 if sum1 is greater than sum2
if (sum1 > sum2) {
    return minSum(nums2, nums1);
```

class Solution:

let sum1 = 0;

let sum2 = 0;

let containsZero = false;

for (const number of nums1) {

containsZero = true;

sum1 += Math.max(number, 1);

sum2 += Math.max(number, 1);

return containsZero ? sum2 : −1;

and m is the length of nums2.

// If sums are equal, return the calculated sum

sum nums1 = sum(nums1) + nums1.count(0)

sum_nums2 = sum(nums2) + nums2.count(0)

def minSum(self, nums1: List[int], nums2: List[int]) -> int:

because the sum and count operations are repeated once for each list.

• The if comparisons are constant time operations, 0(1).

if (number === 0) {

// Calculate sum for nums2

if (sum1 === sum2) {

return sum1;

for (const number of nums2) {

```
if sum nums1 > sum nums2:
    return self.minSum(nums2, nums1)

# If the sums are equal, return the sum (since that is the minimum sum after replacing zeros)
if sum nums1 == sum nums2:
    return sum_nums1

# If there are no zeros in the first list, it's not possible to make the sums equal, return -1
# Otherwise, return the sum of the second list as it is the smaller sum
    return -1 if nums1.count(0) == 0 else sum_nums2

Time and Space Complexity

Time Complexity

The time complexity of the code can be broken down as follows:
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• Counting the zeroes in nums1 and nums2 with nums1.count(0) and nums2.count(0) also takes 0(n) and 0(m) time respectively.

Calculate the sum of elements in each list. The sum includes an extra 1 for each zero found in the list

If the sum of the first list is greater than the second, recursively call minSum with reversed lists

Aggregating all these costs, the total time complexity is 0(n + m) because we are summing separate linear terms associated with each list.

• Calculating sum of nums1 and nums2 requires traversing both arrays, which costs 0(n) and 0(m) respectively, where n is the length of nums1

• The recursive call self.minSum(nums2, nums1) only happens if s1 > s2. If multiple invocations occur, the process will still not exceed 0(n + m)

```
• The space complexity is 0(1) as no additional space that grows with the input size is used. Variables s1 and s2 use constant space, and the
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recursive call does not exceed a single level of stack space since it's a direct swap with no further recursion.