Question 4: Split Array into Two Equal Sum Parts

Problem

Check if an array can be split into two parts such that the sum of the prefix equals the sum of the suffix.

Algorithm

1. Calculate the total sum of the array.
2. Initialize leftSum = 0.
3. Iterate through the array (stopping before the last element): a. Add current element to leftSum. b. Calculate rightSum = totalSum - leftSum. c. If leftSum equals rightSum, return true.
4. If no split point is found, return false.

Program Implementation

cpp

```cpp
#include <iostream>
#include <vector>
using namespace std;

bool canSplitEqualSum(const vector<int>& arr) {
    int totalSum = 0;
    for (int num : arr) {
        totalSum += num;
    }

    int leftSum = 0;
    for (int i = 0; i < arr.size() - 1; i++) {
        leftSum += arr[i];
        int rightSum = totalSum - leftSum;

        if (leftSum == rightSum) {
            return true;
        }
    }

    return false;
}

int main() {
    vector<int> arr1 = {1, 2, 3, 4, 5, 5};
    cout << "Array 1 can be split: " << (canSplitEqualSum(arr1) ? "Yes" : "No") << endl;

    vector<int> arr2 = {1, 2, 3, 4};
    cout << "Array 2 can be split: " << (canSplitEqualSum(arr2) ? "Yes" : "No") << endl;

    vector<int> arr3 = {10, 20, 30, 60};
    cout << "Array 3 can be split: " << (canSplitEqualSum(arr3) ? "Yes" : "No") << endl;

    return 0;
}
```

Time Complexity

- O(n) where n is the size of the array
- One pass to calculate total sum and one pass to find the split point

Space Complexity

- O(1) as we only use constant extra space

Example Explanation

Let's trace through the example using the array [1, 2, 3, 4, 5, 5]:

1. Total sum = 1 + 2 + 3 + 4 + 5 + 5 = 20
2. Iteration through the array:
    - After index 0: leftSum = 1, rightSum = 19, not equal
    - After index 1: leftSum = 3, rightSum = 17, not equal
    - After index 2: leftSum = 6, rightSum = 14, not equal
    - After index 3: leftSum = 10, rightSum = 10, equal!

The function returns true because after index 3, both portions have equal sum.
For array [1, 2, 3, 4], the total sum is 10, and we can't find a split point where the left and right sums are equal.