## PREFIX SUM ARRAY

In this approach, we will try to optimize approach 1. We will use the prefix sum array to reduce the time complexity.

**Following is the algorithm for this approach:**

1. We will create a '*section*' array where '*section[i]*' represents the number of painters that could paint the i-th section.
2. We will create two arrays '*singlePainter*' and '*doublePainter*' where-
    1. '*singlePainter[i]*' represents the number of sections from starting till the i-th section that could be painted by only one painter.
    2. '*doublePainter[i]*' represents the number of sections from starting till the i-th section that could be painted by only two painters.
3. We will have '*total*' as the number of sections that can be painted by all painters together.
4. Consider each pair of painters using two for loops.
5. We will maintain '*currAns*' which will be storing the number of sections that can be painted by painters after removing i-th and j-th painter.
6. '*currAns*' can be calculated in constant time.
    1. 'currAns' is **'total' - (sections that can be only painted by the painter 'i') - (sections that can be only painted by the painter 'j')**.
    2. Let the common range between [li, ri] and [lj, rj] be [l, r].
    3. Now we will add (*singlePainter [r] - singlePainter [l-1])* in '*currAns*'.
        1. This is because we considered this section [l, r] twice during subtraction.
    4. Then, subtract (*doublePainter [r] - doublePainter [l-1])* from '*currAns*'.
        1. This is because the section [l, r] that could be painted by only two painters will become unpainted after removing *'i'*and '*j*' painters.

We will be maintaining the maximum of '*currAns*' in '*maxPainted'*.

## Time Complexity

**O(N + Q * Q)**, where Q is the number of painters.

We are taking linear time for computing the prefix sum arrays and since we are iterating over each pair of painters, the time complexity will be O(N + Q * Q).

## Space Complexity

**O(N)**, where N is the length of the fence.

The O(N) space complexity will be due to *'section', 'singlePainter'* and *'doublePainter'* arrays.