Range Addition

Assume you have an array of length ***n*** initialized with all **0**'s and are given ***k*** update operations.

Each operation is represented as a triplet: **[startIndex, endIndex, inc]** which increments each element of subarray **A[startIndex ... endIndex]** (startIndex and endIndex inclusive) with **inc**.

Return the modified array after all ***k*** operations were executed.

Example:

```
Given:

    length = 5,
    updates = [
        [1,  3,  2],
        [2,  4,  3],
        [0,  2, -2]
    ]

Output:

    [-2, 0, 3, 5, 3]
```

Explanation:

```
Initial state:
[ 0, 0, 0, 0, 0 ]

After applying operation [1, 3, 2]:
[ 0, 2, 2, 2, 0 ]

After applying operation [2, 4, 3]:
[ 0, 2, 5, 5, 3 ]

After applying operation [0, 2, -2]:
[-2, 0, 3, 5, 3 ]
```

1. Thinking of using advanced data structures? You are thinking it too complicated.
2. For each update operation, do you really need to update all elements between i and j?
3. Update only the first and end element is sufficient.
4. The optimal time complexity is O(***k*** + ***n***) and uses O(1) extra space.

Credits:

Special thanks to @vinod23 for adding this problem and creating all test cases.

Solution 1

Just store every start index for each value and at end index plus one minus it

for example it will look like:

[1 , 3 , 2] , [2, 3, 3] (length = 5)

res[0, 2, ,0, 0 -2]

res[0 ,2, 3, 0, -5]

sum 0, 2, 5, 5, 0

res[0, 2, 5, 5, 0]

```
public int[] getModifiedArray(int length, int[][] updates) {

    int[] res = new int[length];
     for(int[] update : updates) {
        int value = update[2];
        int start = update[0];
        int end = update[1];

        res[start] += value;

        if(end < length - 1)
            res[end + 1] -= value;

    }

    int sum = 0;
    for(int i = 0; i < length; i++) {
        sum += res[i];
        res[i] = sum;
    }

    return res;
}
```

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Solution 2

From the hint, we only need to update first and end element, so we update the startIndex with inc, then update endIndex + 1 with -inc.
Using the example in the problem, We get vector nums = {-2, 2, 3, 2, -2, -3}, then we compute range sum (Range Sum Query - Immutable), that is the final result = {-2, 0, 3, 5, 3}.

```
class Solution {
public:
    vector<int> getModifiedArray(int length, vector<vector<int>>& updates) {
        vector<int> res, nums(length + 1, 0);
        for (int i = 0; i < updates.size(); ++i) {
            nums[updates[i][0]] += updates[i][2];
            nums[updates[i][1] + 1] -= updates[i][2];
        }
        int sum = 0;
        for (int i = 0; i < length; ++i) {
            sum += nums[i];
            res.push_back(sum);
        }
        return res;
    }
};
```

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Solution 3

Just use the first position and the**last + 1** position. The last + 1 position add the opposite value. So when you add the numbers from start to end you will have correct result.

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