Prefix Sum Array

Find the sum of elements in a given range [L, R] using a prefix sum array.

Definition

A prefix sum array stores the sum of elements from the start of the array up to each index.

Steps to Solve

1. Create prefix array
2. Compute cumulative sums
3. Use formula to answer queries instantly

Java Code Implementation

```
class PrefixSumExample {
    public static void main(String[] args) {
        int[] arr = {2, 4, 6, 8, 10};
        int n = arr.length;

        // Step 1: Create prefix sum array
        int[] prefix = new int[n];
        prefix[0] = arr[0];

        // Step 2: Build prefix array
        for (int i = 1; i < n; i++) {
            prefix[i] = prefix[i - 1] + arr[i];
        }

        // Query: Find sum from L to R
        int L = 1, R = 3;

        int sum;
        if (L == 0)
            sum = prefix[R];
        else
            sum = prefix[R] - prefix[L - 1];

        System.out.println("Sum from " + L + " to " + R + " = " + sum);
```

```
        }
}
```

⏱️ Time Complexity

Operation	Time
Build Prefix Array	O(n)
Each Query	O(1)

🎯 Why Prefix Sum is Important

It is widely used in:

- Range sum queries
- Competitive programming
- Sliding window problems
- Dynamic programming optimizations
- 2D matrix sum problems