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Subarray with given Sum

Given an unsorted array **arr** of nonnegative integers and an integer **sum**, find a continuous subarray which adds to a given sum. There may be more than one subarrays with sum as the given sum, print first such subarray.

Examples :

Input: `arr[] = {1, 4, 20, 3, 10, 5}`, `sum = 33`

Output: Sum found between indexes 2 and 4

Sum of elements between indices 2 and 4 is $20 + 3 + 10 = 33$

Input: `arr[] = {1, 4, 0, 0, 3, 10, 5}`, `sum = 7`

Output: Sum found between indexes 1 and 4

Sum of elements between indices 1 and 4 is $4 + 0 + 0 + 3 = 7$

Input: `arr[] = {1, 4}`, `sum = 0`

Output: No subarray found

There is no subarray with 0 sum

Simple Approach: A simple solution is to consider all subarrays one by one and check the sum of every subarray. Following program implements the simple solution. Run two loops: the outer loop picks a starting point *i* and the inner loop tries all subarrays starting from *i*.



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Algorithm:

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1. Traverse the array from start to end.
2. From every index start another loop from i to the end of array to get all subarray starting from i , keep a variable sum to calculate the sum.
3. For every index in inner loop update $sum = sum + array[j]$
4. If the sum is equal to the given sum then print the subarray.



C++

Java

```
class SubarraySum {
    /* Returns true if there is a
    subarray of arr[] with a sum equal to
    'sum' otherwise returns false.
    Also, prints the result */
    int subArraySum(int arr[], int n, int sum)
    {
        int curr_sum, i, j;

        // Pick a starting point
        for (i = 0; i < n; i++) {
            curr_sum = arr[i];

            // try all subarrays starting with 'i'
            for (j = i + 1; j <= n; j++) {
```

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```
        if (curr_sum == sum) {
            int p = j - 1;
            System.out.println(
                "Sum found between indexes " + i
                + " and " + p);
            return 1;
        }
        if (curr_sum > sum || j == n)
            break;
        curr_sum = curr_sum + arr[j];
    }

    System.out.println("No subarray found");
    return 0;
}

public static void main(String[] args)
{
    SubarraySum arraysum = new SubarraySum();
    int arr[] = { 15, 2, 4, 8, 9, 5, 10, 23 };
    int n = arr.length;
    int sum = 23;
    arraysum.subArraySum(arr, n, sum);
}

// This code has been contributed by Mayank Jaiswal(mayank_24)
```

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Output

Sum found between indexes 1 and 4

Complexity Analysis:

- **Time Complexity:** $O(n^2)$ in worst case.
Nested loop is used to traverse the array so the time complexity is $O(n^2)$
- **Space Complexity:** $O(1)$.
As constant extra space is required.

Efficient Approach: There is an idea if all the elements of the array are positive. If a subarray has sum greater than the given sum then there is no possibility that adding elements to the current subarray the sum will be x (given sum). Idea is to use a similar approach to a sliding window. Start with an empty subarray, add elements to the subarray until the sum is less than x . If the sum is greater than x , remove elements from the start of the current subarray.

Algorithm:

1. Create two variables, $l=0$, $sum = 0$
2. Traverse the array from start to end.
3. Update the variable sum by adding current element, $sum = sum + array[i]$
4. If the sum is greater than the given sum, update the variable sum as $sum = sum - array[l]$, and update l as, $l++$.
5. If the sum is equal to given sum, print the subarray and break the loop.

C++

Java

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```
class SubarraySum {
    /* Returns true if there is
    a subarray of arr[] with sum equal to
    'sum' otherwise returns false.
    Also, prints the result */
    int subArraySum(int arr[], int n, int sum)
    {
        int curr_sum = arr[0], start = 0, i;

        // Pick a starting point
        for (i = 1; i <= n; i++) {
            // If curr_sum exceeds the sum,
            // then remove the starting elements
            while (curr_sum > sum && start < i - 1) {
                curr_sum = curr_sum - arr[start];
                start++;
            }

            // If curr_sum becomes equal to sum,
            // then return true
            if (curr_sum == sum) {
                int p = i - 1;
                System.out.println(
                    "Sum found between indexes " + start
                    + " and " + p);
                return 1;
            }
        }
    }
}
```

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```
// Add this element to curr_sum  
if (i < n)  
    curr_sum = curr_sum + arr[i];  
}
```

```
System.out.println("No subarray found");
```

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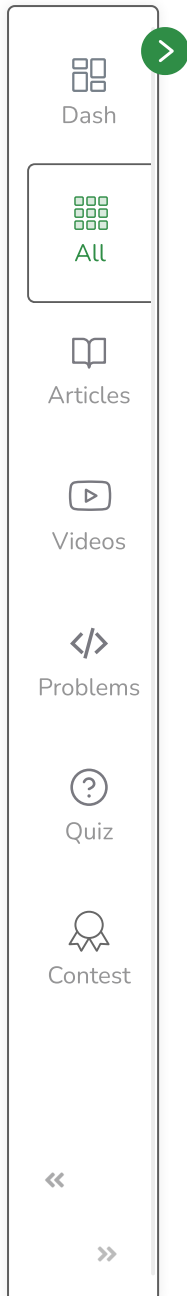
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public static void main(String[] args)  
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    int arr[] = { 15, 2, 4, 8, 9, 5, 10, 23 };  
    int n = arr.length;  
    int sum = 23;  
    arraysum.subArraySum(arr, n, sum);  
}
```

```
// This code has been contributed by Mayank Jaiswal(mayank_24)
```

Output

Sum found between indexes 1 and 4

Complexity Analysis:



- **Time Complexity :** $O(n)$.

- The Array is traversed only once to insert elements into the window. If
- The Array is traversed again once to remove elements from the window.
- So the total time will be $O(N) + O(N) = O(2*N)$, which is similar to $O(N)$.

- **Space Complexity:** $O(1)$.

As constant extra space is required.

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