Find if there is a subarray with 0 sum

Given an array of positive and negative numbers, find if there is a subarray with 0 sum.

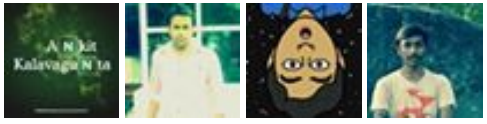
Examples:

```
Input: {4, 2, -3, 1, 6}
Output: true
There is a subarray with zero sum from index 1 to 3.

Input: {4, 2, 0, 1, 6}
Output: true
There is a subarray with zero sum from index 2 to 2.

Input: {-3, 2, 3, 1, 6}
Output: false
There is no subarray with zero sum.
```

We strongly recommend to minimize the browser and try this yourself first.

A **simple solution** is to consider all subarrays one by one and check the sum of every subarray. We can run two loops: the outer loop picks a starting point i and the inner loop tries all subarrays starting from i (See this for implementation). Time complexity of this method is $O(n^2)$.

We can also **use hashing**. The idea is to iterate through the array and for every element arr[i], calculate sum of elements form 0 to i (this can simply be done as sum += arr[i]). If the current sum has been seen before, then there is a zero sum array. Hashing is used to store the sum values, so that we can quickly store sum and find out whether the current sum is seen before or



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not.

Following is Java implementation of the above approach.

```
// A Java program to find if there is a zero sum subarray
import java.util.HashMap;

class ZeroSumSubarray {

    // Returns true if arr[] has a subarray with sero sum
    static Boolean printZeroSumSubarray(int arr[])
    {
        // Creates an empty hashMap hM
        HashMap<Integer, Integer> hM = new HashMap<Integer, Integer>()

        // Initialize sum of elements
        int sum = 0;

        // Traverse through the given array
        for (int i = 0; i < arr.length; i++)
        {
            // Add current element to sum
            sum += arr[i];

            // Return true in following cases
            // a) Current element is 0
            // b) sum of elements from 0 to i is 0
            // c) sum is already present in hash map
            if (arr[i] == 0 || sum == 0 || hM.get(sum) != null)
               return true;

            // Add sum to hash map
            hM.put(sum, i);
        }

        // We reach here only when there is no subarray with 0 sum
        return false;
    }

    public static void main(String arg[])
    {
        int arr[] = {4, 2, -3, 1, 6};
        if (printZeroSumSubarray(arr))
            System.out.println("Found a subarray with 0 sum");
        else
            System.out.println("No Subarray with 0 sum");
    }
```

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```
}
```

Output:

```
Found a subarray with 0 sum
```

Time Complexity of this solution can be considered as O(n) under the assumption that we have good hashing function that allows insertion and retrieval operations in O(1) time.

Exercise:
Extend the above program to print starting and ending indexes of all subarrays with 0 sum.

This article is contributed by **Chirag Gupta**. Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above

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Writing code in comment? Please use **ideone.com** and share the link here.

23 Comments GeeksforGeeks

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AlienOnEarth • 8 days ago

Another approach with o(n) time complexity and o(1) space complexity.

void findZeroSumSubarray(int arr[], int n)

{

int j=0,i=0;

int cur_sum = 0;

int found = 0;

while(i<n) {="" cur_sum="cur_sum" +="" arr[i];="" slide="" window="" if="" curr
while(j<i="" &&="" cur_sum="">0)

{

cur_sum = cur_sum - arr[j];

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kzs please provide solution for the problem...
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Sanjay Agarwal You can also use the this method:...
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j++;

see more

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YoYoHoneySingh • a month ago

I think the logic is simply explained like this: Keep storing sum till index "i". for a
that of "i", this means all the elements between "i" index and "j" index add up to
"j".

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Sidharth • a month ago

Hi, How does the third condition proves that there might be a zero sum subarr

^ | v • Reply • Share ›

Guest • a month ago

Could anyone please describe how do we come up with the below logic ?

If the current sum has been seen before, then there is a zero sum array.

Shall we apply the same logic to find the given sum(x) subarray in an array ?

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Srinivas • a month ago

I don't think this solution will work. and the brute force approach time complexi

^ | v • Reply • Share ›

AlienOnEarth ➚ Srinivas • a month ago

can you please provide reason

^ | v • Reply • Share ›

I guess I didn't go thru the solution properly. It works fine. My ba

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Venu Gopal AlienOnEarth • a month ago

It is clear that there is subset {-4, -2, 6} for
arr[] = {-4, -2, -3, 1, 6}, but this code gives wrong o/p..
http://ideone.com/FcUWve check this. otherwise if the above c
then it should be mentioned in the problem statement... correct

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Kartik Venu Gopal • a month ago

Please take a closer look at the problem statement. It is

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alien • a month ago

Hi Geeksforgeeks,

I have another O(n) time and space solution for this problem.

int sumZero(int arr[], int n)

{

int i =0;

int start =0;

int sum = 0;

while(i<n) {="" sum="sum" +="" arr[i];="" while(sum="">0 && start<i) {="" sum
}="" if(sum="=" 0)="" {="" printf("start:="" %d,="" i:="" %d",start,i);="" return;="
i++;="" }="" printf("no="" match="" found");="" }="" i="" request="" you="" to="
it="" in="" the="" solution.="">

GeeksforGeeks Mod ➚ alien • a month ago

alie, could you please post your code on ideone.com and share the link

vrg • a month ago

how is negative index handled?

for ex:
If Input: {-3, 2, 3, 1, 6}

During 1st iteration when i=0
sum=-3 and how/where is -3 stored in hashtable?

hM.put(sum, i);

hm.put(-3,0) where is this stored?

Ankur gupta • a month ago

Hash map method doesn't work for example1 also.

Kartik ➚ Ankur gupta • a month ago

It seems to be working fine. See http://ideone.com/pKPxnU

Rajat Sadh • a month ago

http://ideone.com/FswPty

Ravi ➚ Rajat Sadh • a month ago

Doesn't work for many cases, ex {3, -2, -1, -3, 6}. There is a subarray,

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zzer Ravi • a month ago

it checks if sum==0, so the code will find it

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GOPI GOPINATH • a month ago

is the hashmap package existing ?? or we need to write our own hashmap an

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Ravi GOPI GOPINATH • a month ago

it is part of standard java

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GOPI GOPINATH Ravi • a month ago

forgot about the case of the letter 'h' in hashmap...got it !

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Babu • a month ago

Any specific reason why we are starting from i=1 . int i = 1 not i=0

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GeeksforGeeks Mod Babu • a month ago

Babu, that seemed to be typo. Thanks for pointing this out. We have c

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Praveen GeeksforGeeks • 3 days ago

Could you put both the Alien's methods on ideone and place the

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