Kadane's Algorithm

Print Screen

Maximum Subarray Sum

continuous

n

1	2	3	4	5

1, 2, 3, 4, 5

12, 23, 34, 45

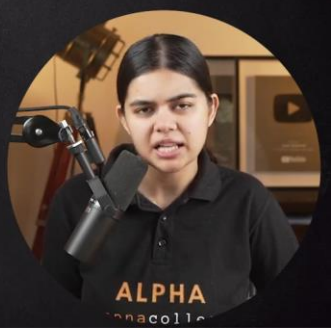
123, 234, 345

1234, 2345

12345

$\#subarr = \frac{n*(n+1)}{2}$

$n=5 \Rightarrow \frac{5*6}{2} = 15$



Print Screen

Maximum Subarray Sum

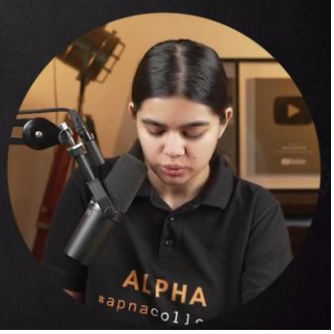
continuous part

1	2	3	4	5

start: 0, 1, 2

end (st to n-1): 0,1,2,3,4 ; 1,2,3,4 ; 2,3,4

```
for(st = 0; st < n; st++) {
    for(end = st; end < n; end++) {
        => (st to end)
    }
}
```



Print Screen

code.cpp

```cpp
#include <iostream>
#include <vector>
using namespace std;

int main() {
    int n = 5;
    int arr[5] = {1, 2, 3, 4, 5};

    for(int st=0; st<n; st++) {
        for(int end=st; end<n; end++) {
            for(int i=st; i<=end; i++) {
                cout << arr[i];
            }
            cout << " ";
        }
        cout << endl;
    }

    return 0;
}
```

PORTS PROBLEMS DEBUG CONSOLE OUTPUT TERMINAL

```
apnacollege@Shradha DSAseries % g++ -std=c++11 code.cpp && ./a.out
1 12 123 1234 12345
2 23 234 2345
3 34 345
4 45
5
apnacollege@Shradha DSAseries %
```

Print Screen

Maximum Subarray Sum

Brute Force Approach

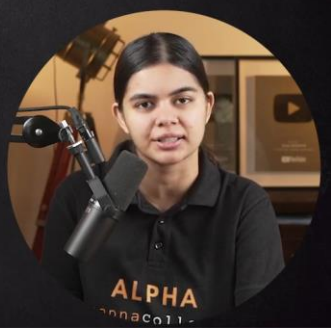
{ 3, -4, 5, 4, -1, 7, -8 }

st = 0

$O(n^3)$

```
for(st = 0; st < n; st++) {
    for(end = st; end < n; end++) {
        ⇒ (st to end)
    }
}
```

Print Screen



Maximum Subarray Sum

Brute Force Approach

{ 3, -4, 5, 4, -1, 7, -8 }

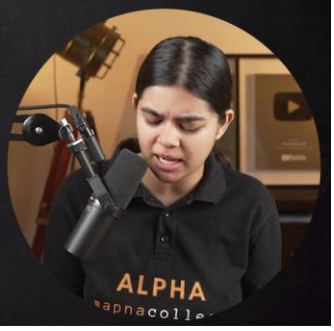
st = 0 end

CS = -1 + 5 = 4

$O(n^3)$

```
maxSum
for(st = 0; st < n; st++) {
    currSum = 0
    for(end = st; end < n; end++) {
        cs += arr[end]
        maxSum = max(CS, MS);
    }
}
return MS
```

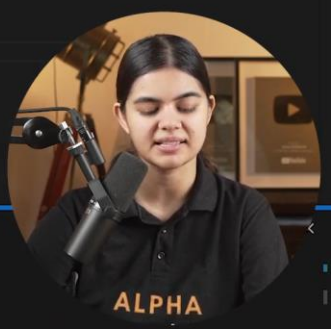
Print Screen



code.cpp

```cpp
int main() {
    int n = 5;
    int arr[5] = {1, 2, 3, 4, 5};

    int maxSum = INT_MIN;

    for(int st=0; st<n; st++) {
        int currSum = 0;
        for(int end=st; end<n; end++) {
            currSum += arr[end];
            maxSum = max(currSum, maxSum);
        }
    }

    cout << "max subarray sum = " << maxSum << endl;

    return 0;
}
```

```
PORTS  PROBLEMS  DEBUG CONSOLE  OUTPUT  TERMINAL
apnacollege@Shradha DSAseries % g++ -std=c++11 code.cpp && ./a.out
max subarray sum = 15
apnacollege@Shradha DSAseries %
```



Kadane's Algorithm

Most Optimised

{ 3, -4, 5, 4, -1, 7, -8 }

Intuition

+ve + +ve → +

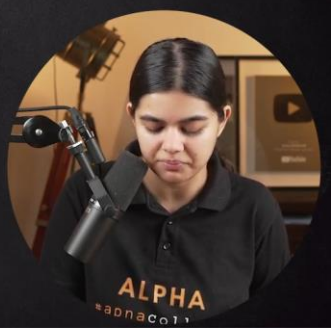
-ve + +ve → +

+ve + -ve → -ve

reset to 0

currSum = 0 maxSum = INT_MIN

```
for(i=0; i<n; i++){
    currSum += arr[i]
    maxSum = max(CS, MS)
    if(CS < 0)
        CS = 0
}
```



Kadane's Algorithm

Most Optimised

{ 3, -4, 5, 4, -1, 7, -8 }

CS = 0 3 -1 5 9 8 15 7

MS = -∞ 3 5 9 15

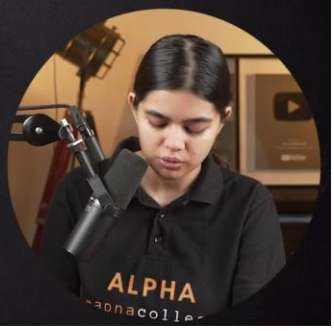
edge / corner

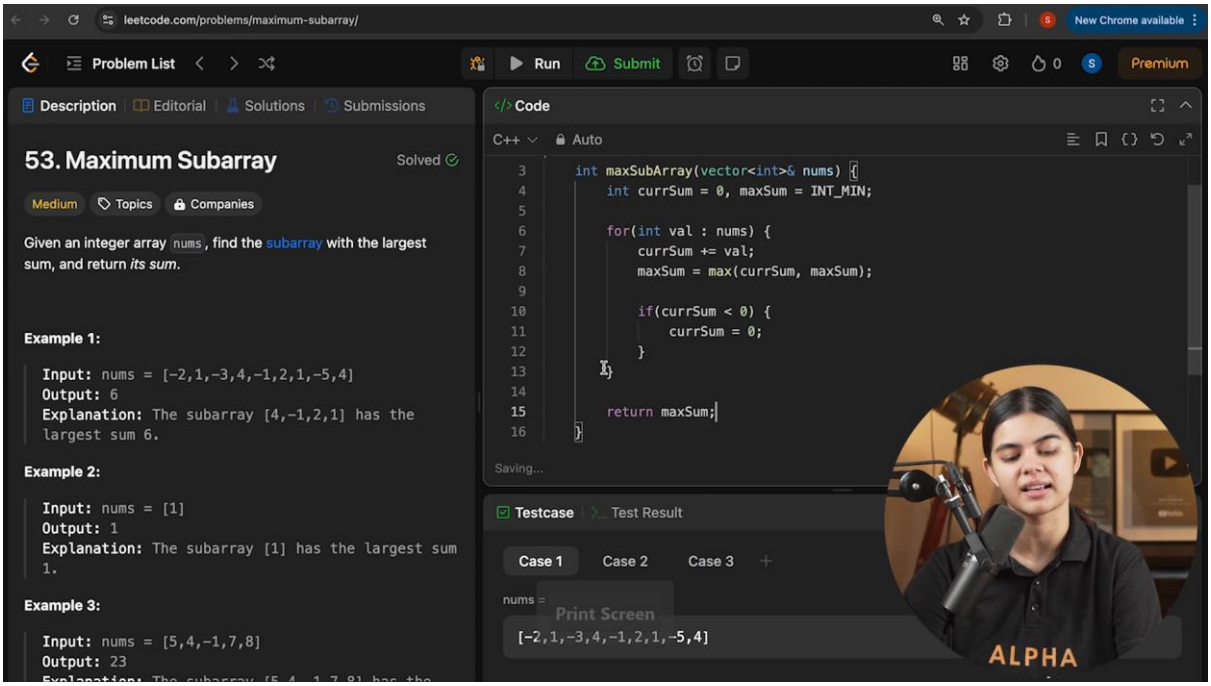
arr = [-1, -2, -3, -4, -5]

maxSubSum = -ve

currSum = 0 maxSum = INT_MIN

```
for(i=0; i<n; i++){
    currSum += arr[i]
    maxSum = max(CS, MS)
    if(CS < 0)
        CS = 0
}
```




leetcode.com/problems/maximum-subarray/
New Chrome available
Problem List
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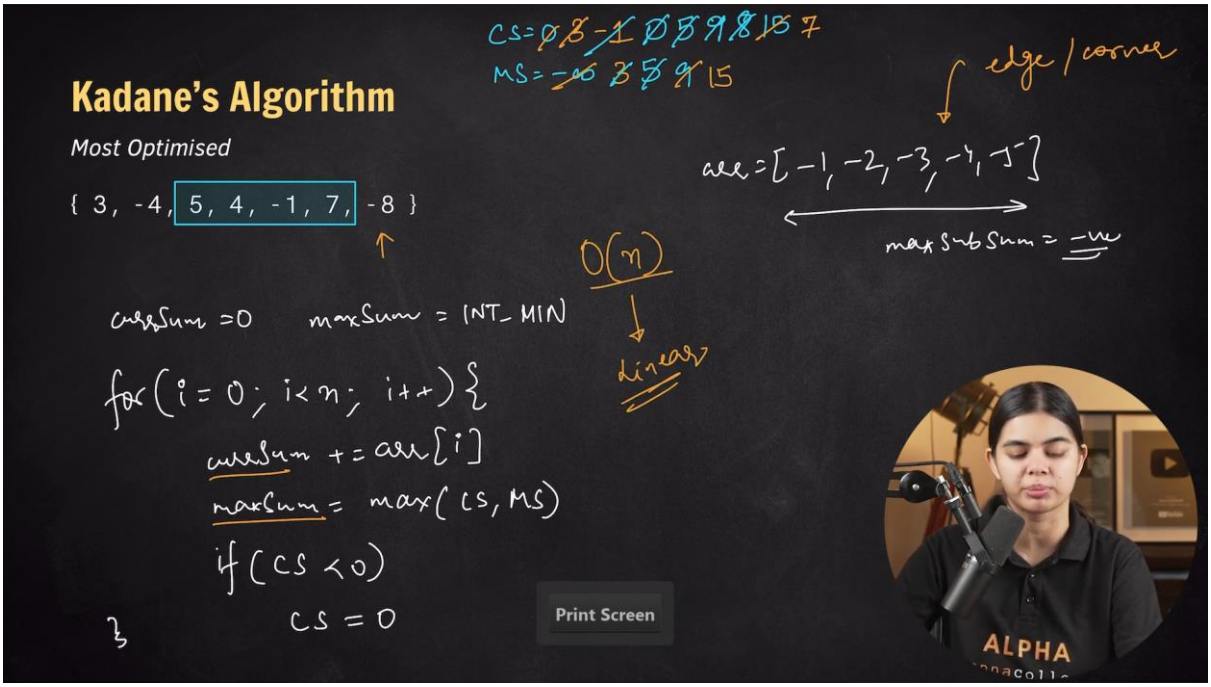
Description
Editorial
Solutions
Submissions
53. Maximum Subarray
Solved
Medium
Topics
Companies
Given an integer array nums, find the subarray with the largest sum, and return its sum.
Example 1:
Input: nums = [-2,1,-3,4,-1,2,1,-5,4]
Output: 6
Explanation: The subarray [4,-1,2,1] has the largest sum 6.
Example 2:
Input: nums = [1]
Output: 1
Explanation: The subarray [1] has the largest sum 1.
Example 3:
Input: nums = [5,4,-1,7,8]
Output: 23
Code
C++
Auto
int maxSubArray(vector<int>& nums) {
int currSum = 0, maxSum = INT_MIN;
for(int val : nums) {
currSum += val;
maxSum = max(currSum, maxSum);
if(currSum < 0) {
currSum = 0;
}
}
return maxSum;
}
Saving...
Testcase
Test Result
Case 1
Case 2
Case 3
nums =
[-2,1,-3,4,-1,2,1,-5,4]
Print Screen
ALPHA


Kadane's Algorithm
Most Optimised
{ 3, -4, 5, 4, -1, 7, -8 }
currSum =0
maxSum = INT_MIN
for(i=0; i<n; i++){
currSum += arr[i]
maxSum = max(cs, MS)
if(cs<0)
cs = 0
}
O(n)
linear
edge / corner
Print Screen
ALPHA