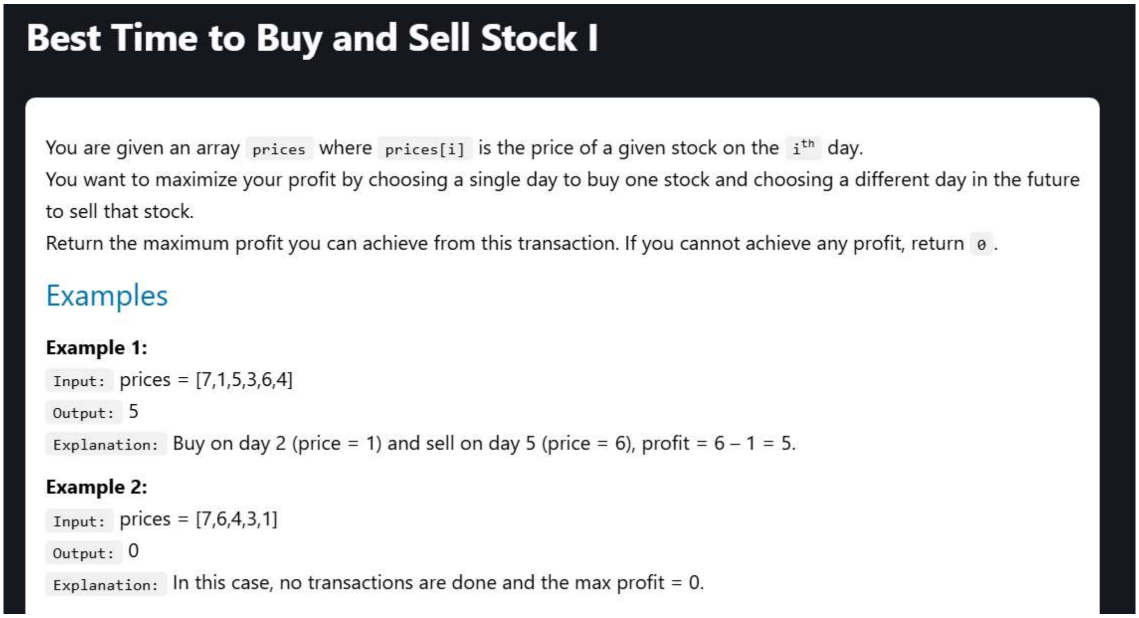
Best Time to Buy and Sell Stock 1



Best Time to Buy and Sell Stock I

You are given an array `prices` where `prices[i]` is the price of a given stock on the `i`th day.
You want to maximize your profit by choosing a single day to buy one stock and choosing a different day in the future to sell that stock.
Return the maximum profit you can achieve from this transaction. If you cannot achieve any profit, return `0`.

Examples

Example 1:
`Input:` prices = [7,1,5,3,6,4]
`Output:` 5
`Explanation:` Buy on day 2 (price = 1) and sell on day 5 (price = 6), profit = 6 – 1 = 5.

Example 2:
`Input:` prices = [7,6,4,3,1]
`Output:` 0
`Explanation:` In this case, no transactions are done and the max profit = 0.

Constraints

1 <= prices.length <= 10^5
0 <= prices[i] <= 10^4

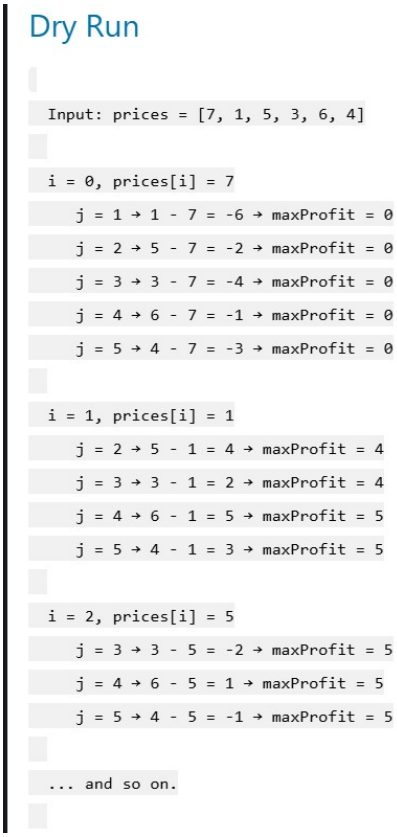
Approach 1 (Brute Force)

Initialize `maxProfit = 0`.

Use two nested loops:

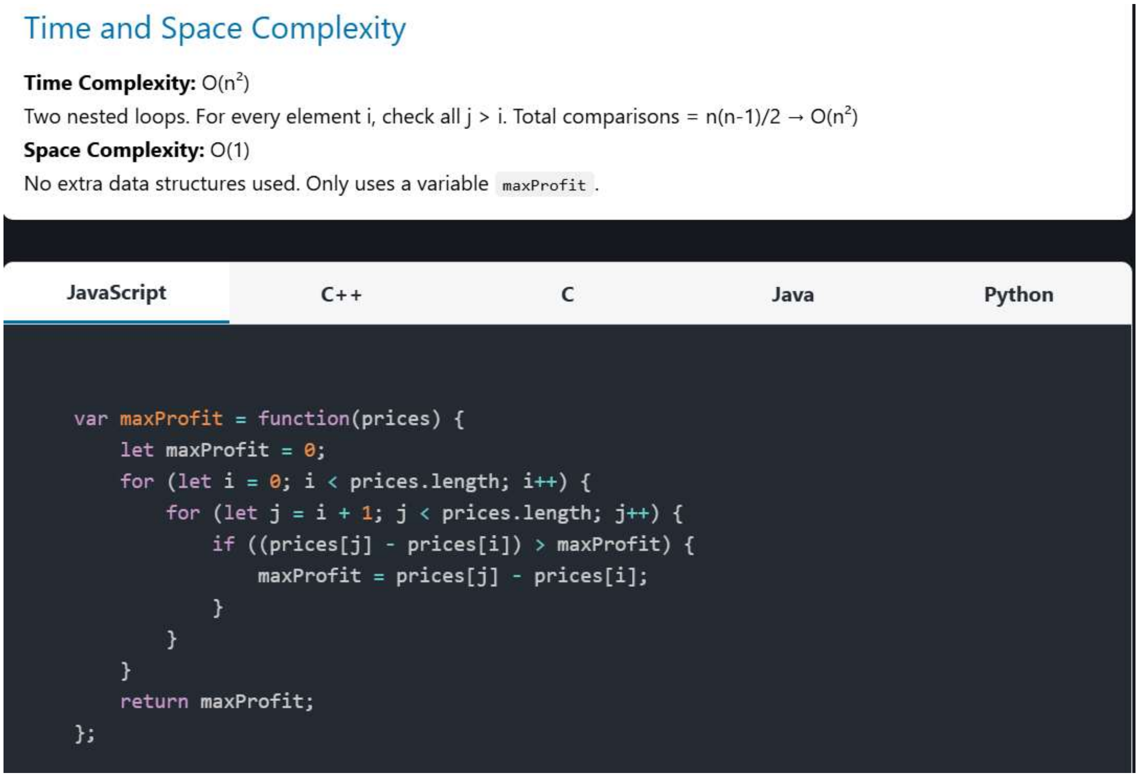
Outer loop picks a day `i` to buy the stock.
Inner loop picks a day `j > i` to sell the stock.
For every pair `(i, j)`, calculate the profit: `prices[j] - prices[i]`.
If this profit is greater than `maxProfit`, update `maxProfit`.

Return `maxProfit` after all iterations.



Dry Run

```
Input: prices = [7, 1, 5, 3, 6, 4]

i = 0, prices[i] = 7
   j = 1 → 1 - 7 = -6 → maxProfit = 0
   j = 2 → 5 - 7 = -2 → maxProfit = 0
   j = 3 → 3 - 7 = -4 → maxProfit = 0
   j = 4 → 6 - 7 = -1 → maxProfit = 0
   j = 5 → 4 - 7 = -3 → maxProfit = 0

i = 1, prices[i] = 1
   j = 2 → 5 - 1 = 4 → maxProfit = 4
   j = 3 → 3 - 1 = 2 → maxProfit = 4
   j = 4 → 6 - 1 = 5 → maxProfit = 5
   j = 5 → 4 - 1 = 3 → maxProfit = 5

i = 2, prices[i] = 5
   j = 3 → 3 - 5 = -2 → maxProfit = 5
   j = 4 → 6 - 5 = 1 → maxProfit = 5
   j = 5 → 4 - 5 = -1 → maxProfit = 5

... and so on.
```



Time and Space Complexity

Time Complexity: O(n^2)

Two nested loops. For every element i, check all j > i. Total comparisons = n(n-1)/2 → O(n^2)

Space Complexity: O(1)

No extra data structures used. Only uses a variable `maxProfit`.

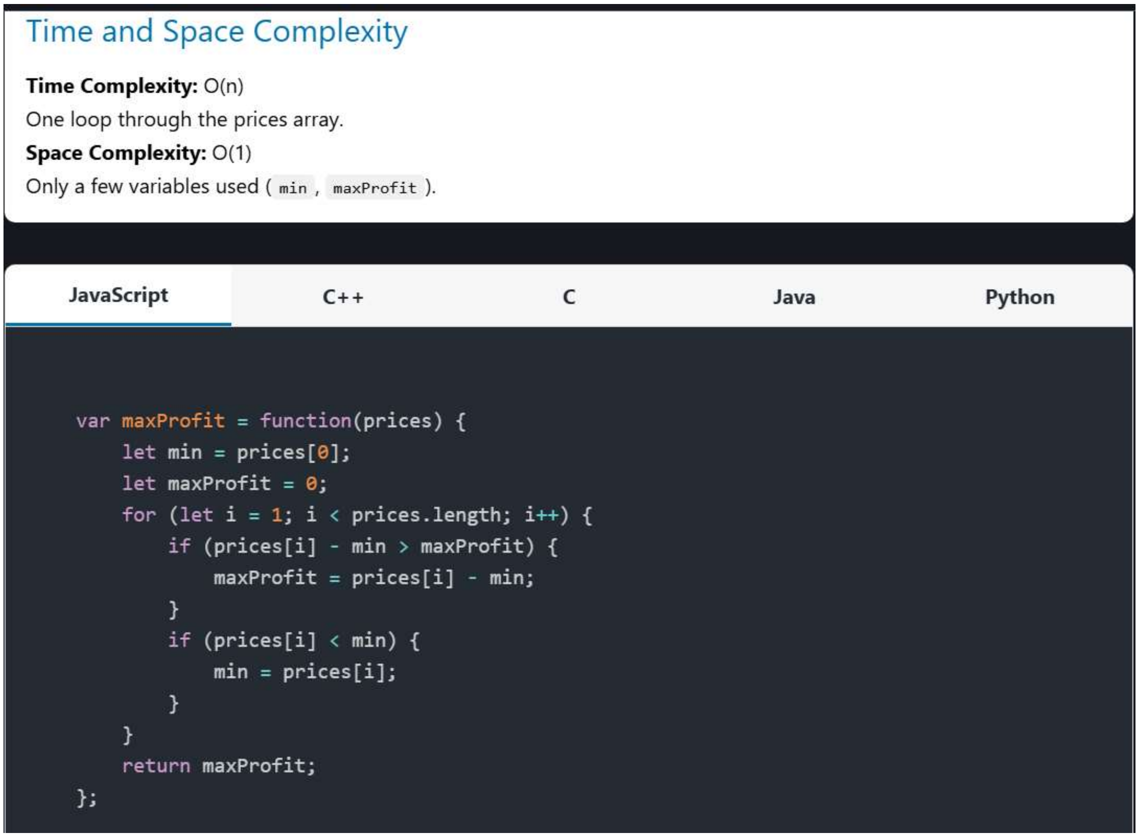
```
var maxProfit = function(prices) {
    let maxProfit = 0;
    for (let i = 0; i < prices.length; i++) {
        for (let j = i + 1; j < prices.length; j++) {
            if ((prices[j] - prices[i]) > maxProfit) {
                maxProfit = prices[j] - prices[i];
            }
        }
    }
    return maxProfit;
};
```

Approach 2 (Optimal)

Initialize `min` as the first price.
Initialize `maxProfit` as 0.
Loop through the prices from index 1 to the end:
If the current price minus min is greater than maxProfit, update maxProfit.
If the current price is less than min, update min to this new lower value.
Return `maxProfit` at the end.

Dry Run

```

prices = [7, 1, 5, 3, 6, 4]
min = 7, maxProfit = 0

i = 1 → prices[1] = 1
1 < 7 → update min = 1

i = 2 → prices[2] = 5
5 - 1 = 4 > 0 → update maxProfit = 4

i = 3 → prices[3] = 3
3 - 1 = 2 < 4 → no change

i = 4 → prices[4] = 6
6 - 1 = 5 > 4 → update maxProfit = 5

i = 5 → prices[5] = 4
4 - 1 = 3 < 5 → no change

➡️ Final maxProfit = 5 ✅

```



Time and Space Complexity

Time Complexity: O(n)

One loop through the prices array.

Space Complexity: O(1)

Only a few variables used (`min` , `maxProfit`).

```javascript
var maxProfit = function(prices) {
    let min = prices[0];
    let maxProfit = 0;
    for (let i = 1; i < prices.length; i++) {
        if (prices[i] - min > maxProfit) {
            maxProfit = prices[i] - min;
        }
        if (prices[i] < min) {
            min = prices[i];
        }
    }
    return maxProfit;
};
```