**The Great Computer Challenge, 2023**

***Scientific/Non-Business Programming, Level 4***

# **Background: GCC: Programming Scientific Non-Business**

# **Guidelines & Requirements**

Internet access is strictly prohibited; all programming should be completed in local environments.

# **Challenge 1: Portfolio Manager**

You are a portfolio manager. You are given an integer array **prices** where **prices[i]** is the price of a given stock on the i th day. On each day, you may decide to buy and/or sell the stock. You can only hold at most one share of the stock at any time. However, you can buy it then immediately sell it on the same day.

***Example 1:***

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

Output: 7

Explanation: Buy on day 2 (price = 1) and sell on day 3 (price = 5), profit = 5-1 = 4.

Then buy on day 4 (price = 3) and sell on day 5 (price = 6), profit = 6-3 = 3.

Total profit is 4 + 3 = 7.

***Example 2:***

Input: **prices** = [1,2,3,4,5]

Output: 4

Explanation: Buy on day 1 (price = 1) and sell on day 5 (price = 5), profit = 5-1 = 4.

Total profit is 4.

***Example 3:***

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

Output: 0

Explanation: There is no way to make a positive profit, so we never buy the stock to achieve the maximum profit of 0.

**Write code to help you find and return the maximum profit you can achieve. Apply your code on the following three test cases and yield correct answers:**

1. Prices = [3,1,4,1,5,9,2,6]

2. Prices = [2,7,1,8,2,8]

3. Prices = [1,4,1,4,2,1,3,5,6,2,3,7]

# **Challenge 2: Longest Substring**

Given a string **s**, find the length of the longest substring without repeating characters.

***Example 1:***

Input: **s** = "abcabcbb"

Output: 3

Explanation: The answer is "abc", with the length of 3.

***Example 2:***

Input: **s** = "bbbbb"

Output: 1

Explanation: The answer is "b", with the length of 1.

***Example 3:***

Input: **s** = "pwwkew"

Output: 3

Explanation: The answer is "wke", with the length of 3.

Notice that the answer must be a substring, "pwke" is a subsequence and not a substring.

**Write code and apply it on the following three test cases, and yield correct answers**:

1. **s** = " alltheworldsastageandallthemenandwomenmerelyplayers"

2. **s** = " lifeislikeridingabicycle"

3. **s** = "aphysicistisjustanatomswayoflookingatitself"

# **Challenge 3: Dice Game**

Peter has nine four-sided (pyramidal) dice, each with faces numbered 1, 2, 3, 4.

Colin has six six-sided (cubic) dice, each with faces numbered 1, 2, 3, 4, 5, 6.

Peter and Colin roll their dice and compare totals: the highest total wins. The result is a draw if the totals are equal.

What is the probability that Pyramidal Peter beats Cubic Colin? Give your answer rounded to seven decimal places in the form 0.abcdefg

# **Judging Criteria**

Total: 100 pt

Challenge 1 (40 pts):

- Correct output for the test case = 8 pt / each

- Implementing the solution in two different ways (with correct outputs):

o Implementation with dynamic programming = 8 pt

o Implementation with greedy algorithm = 8 pt

Challenge 2 (30 pts):

- Correct output for the test case = 6 pt / each

- Give correct explanation for each correct output = 4 pt / each

Challenge 3 (30 pts):

- Correct output = 20 pt

- Give correct mathematical explanation of the solution (no matter whether output is correct or not) = 10 pt

***Have fun and thanks for participating in the   
Great Computer Challenge, 2023!***