Assignment Three

Name	
Student number	

Direction:

Please answer all the questions below and hand in your answers before the due day. All work, must be handed in ON TIME.

Due Date:

Jun 5, 2022. Please hand it in by the class time.

Questions:

1. Please describe your understanding of dynamic programming.

2. You are given an array *prices* where prices[i] is the price of a given stock on the i-th day. Find the maximum profit you can achieve. You can only hold at most one share of the stock at any time. After you sell your stock, you cannot buy stock on the next day (i.e., cooldown one day). You may not engage in multiple transactions simultaneously (i.e., you must sell the stock before you buy again).

```
Example:
Input: [1,2,3,0,2]
Output: 3
Explanation: transactions = [buy, sell, cooldown, buy, sell]
```

   Please write the pseudocode or C++ code of ***dynamic programming*** to solve this problem

3. The background is the same as the previous question. On each day, you may decide to buy and/or sell the stock. However, you can buy it then immediately sell it on the same day (no cooling time). Find and return the maximum profit you can achieve.

```
Example:
Input: [7,1,5,3,6,4]
Output: 7
Explanation: [do nothing, buy, sell, buy, sell, do nothing]
```

   Please write the pseudocode or C++ code of ***greedy algorithm*** to solve this problem

Assignment Three - Programming

Problem:

Matrix chain multiplication is an optimization problem that to find the most efficient way to multiply a given sequence of matrices. The problem is not actually to perform the multiplications but merely to decide the sequence of the matrix multiplications involved.

The matrix multiplication is associative as no matter how the product is parenthesized, the result obtained will remain the same. For example, for four matrices A, B, C, and D, we would have:

$$((\mathrm{AB})\mathrm{C})\mathrm{D} = ((\mathrm{A}(\mathrm{BC}))\mathrm{D}) = (\mathrm{AB})(\mathrm{CD}) = \mathrm{A}((\mathrm{BC})\mathrm{D}) = \mathrm{A}(\mathrm{B}(\mathrm{CD}))$$

There is a sequence of N matrices $A_1, A_2, \ldots A_n$, where A_i is a $P_{i-1} \times P_i$ matrix. You are given a input vector $P = \left[P_0，P_1 \ldots P_n\right]$ of the matrix chain above , and should determine the order of multiplication that minimize the total number of basic operations. Return the minimum number of basic operations.

Core function:

```
int matrixChainMultiplication(vector<int> &P) {
    // Calculate the minimum number of basic operations.
}
```

Test Cases:

Case 1:

```
Input: P = [10, 30, 5, 60]
Output: 4500
Explanation:
(AB)C needs (10×30×5) + (10×5×60) = 4500 operations,
A(BC) needs (30×5×60) + (10×30×60) = 27000 operations.
```

Case 2:

```
Input: P = [30, 35, 15, 5, 10, 20, 25]
Output: 15125
Explanation: (A(BC))((DE)F) needs 15125 operations.
```

Case 3:

```
Input: P = [10, 30]
Output: 0
```

Keypoints:

- You can choose any programming language to implement this problem.
- You should use ***dynamic programming*** to solve the problem
- Your program should run successfully, output the correct answer for every test case and provide **screenshots of the output results**
- Please make sure there are necessary comments in your source code. **Plagiarism is strictly forbidden!**

Submission:

- Source codes without project files.
- A brief documentation (PDF is recommended), including algorithm idea, algorithm complexity analysis, and screenshots of running results.
- Pack all above files **with the answer of the calculation questions**, and compress them into a **ZIP** file. Please rename the **ZIP** file as '**StudentID_Name_Assignment_3.zip**'.
- Send the zip file to the email:
  - **1012376712@qq.com**
- Please send the email by **Jun.5, 2022.**