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भारतीय प्रौद्योगिकी संस्थान हैदराबाद
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Algorithms and Data Structures: Dynamic Programming

Exercise - 8

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Datum: 14.11.2023

Write the most efficient algorithm for the following problems in C++ and mention the Time and Space Complexity of your algorithms in the comments (at the end). The time limit per test case for all the problems is 1 second. The memory limit per test case for all the problems is 256 MB.

1. **You are given an integer array coins, representing coins of different denominations and an integer amount representing a total amount of money. Return the number of combinations that make up that amount. If that amount of money cannot be made up by any combination of the coins, return 0. You may assume that you have an infinite number of each kind of coin**

   Constraints:

   - 1 <= coins.length <= 5000
   - 1 <= coins[i] <= 5000
   - All the values of coins are unique.
   - 0 <= amount <= 5000

   Test Cases:

   Input: amount = 5, array = [1,2,5].

   Output: 4.

   Explanation: There are four ways.
   5 = 5,
   5 = 2 + 1 + 1,
   5 = 2 + 2 + 1,
   5 = 1 + 1 + 1 + 1 + 1.
   Input: amount = 3, array = [2].

   Output: 0.

   Explanation: There are 0 ways.

2. **Given a m x n grid filled with non-negative numbers, find a path from top left to bottom right, which minimizes the sum of all numbers along its path. Note: You can only move either down or right at any point in time**

Constraints:

- m == grid.length
- n == grid[i].length
- 1 <= m, n <= 5000
- 0 <= grid[i][j] <= 100

Test Cases:

Input: grid = [[1,3,1], [1,5,1], [4,2,1]].
Output: 7.
Explanation: The path $1 \rightarrow 3 \rightarrow 1 \rightarrow 1 \rightarrow 1$ has least sum.

3. **Harry has been given a string s. His instructor has asked him to return the length of the longest palindromic substring.**

Constraints:

- 1 <= s.length <= 5000
- s consist of only digits and English letters.

Test Cases:

Input: s = "babad".
Output: 3.
Explanation: The length of "aba" or "bab" is 3.

4. **Larry has been given an array of integers. He has been asked to return an integer which is the maximum subarray sum. If the maximum subarray sum is negative then return 0.**

Constraints:

- 1 <= nums.length <= 10^5
- -10^4 <= nums[i] <= 10^4

Test Cases:

Input: array = [1, -2, 5, -3, 4].
Output: 5.
Explanation: The maximum sub-array sum is 5 (5).

5. **You have been given a binary matrix of size mxn filled with 0's and 1's. Can you find maximum area of square filled with 1's only.**

   Constraints:

   - m == grid.length
   - n == grid[i].length
   - 1 <= m, n <= 5000
   - 0 <= grid[i][j] <= 100

   Test Cases:

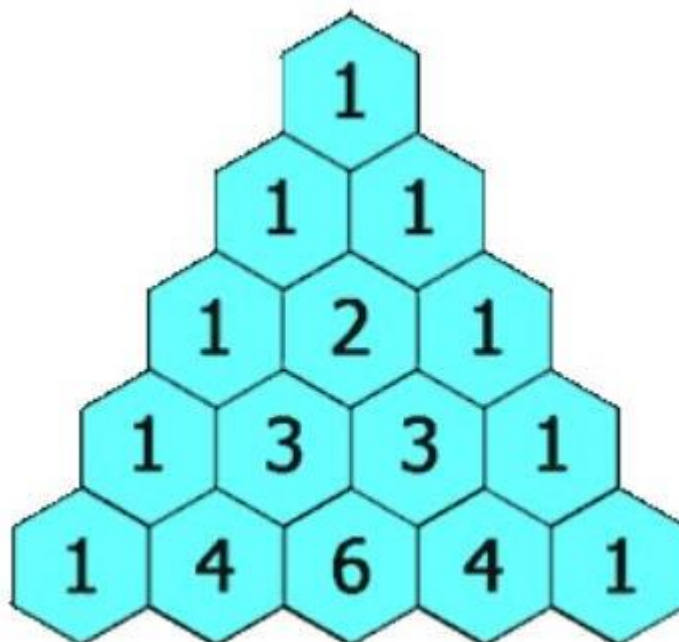   Input: grid = [["0","1"],["1","0"]].
   Output: 1.

6. **You have been given the index of row of the Pascal's triangle. You have to return all the elements present in that row of the Pascal's triangle.**

   Constraints:

   - 1<= rowIndex <= 5000.

   Test Cases:

   Input: 4.
   Output: [1,4,6,4,1].
   Explanation: