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SC - 504 Coputation Lab
C programming test - 2
M.Sc. Scientific Computing

Time: 11:15 AM to 12:45 PM   Date: September 2, 2024   Max mark: 30

1. **Attempt any two:**

   (a) Read 5 real numbers (double) from the user using arrays and perform the following : (3)

       a) Compute sum of all the elements in the array and print it

       b) Compute product of all the elements in the array and print it

   (b) Given a square matrix mat, return the sum of the matrix diagonals. Only include the sum of all the elements on the primary diagonal and all the elements on the secondary (anti) diagonal that are not part of the primary diagonal. (3)

   Example 1:
   Input: mat = [[1,2,3], [4,5,6], [7,8,9]]
   Output: 25
   Explanation: Diagonals sum: $1 + 5 + 9 + 3 + 7 = 25$
   Notice that element mat[1][1] = 5 is counted only once.

   (c) Read 10 integers from the user and perform the following : (3)

       a) Find the maximum value from the given array

       b) Find the minimum value from the given array

2. **Attempt ALL:**

   (a) Read two matrice from user and print their multiplication (4)

   (b) Write a program to determine if a number n is happy. A happy number is a number defined by the following process: (4)

       a) Starting with any positive integer, replace the number by the sum of the squares of its digits.

       b) Repeat the process until the number equals 1 (where it will stay), or it loops endlessly in a cycle which does not include 1.

       c) Those numbers for which this process ends in 1 are happy.

   Print true if n is a happy number, and false if not.

   Example :
   Input: $n = 19 \Longrightarrow$ Output: true
   Explanation:
   $1^2 + 9^2 = 82$; $8^2 + 2^2 = 68$; $6^2 + 8^2 = 100$; $1^2 + 0^2 + 0^2 = 1$

   (c) You are given an $m \times n$ integer grid (matrix) accounts where $accounts[i][j]$ is the amount of money the ith customer has in the jth bank. Return the wealth that the richest customer has. A customer's wealth is the amount of money they have in all their bank accounts. The richest customer is the customer that has the maximum wealth. (4)

Example 1:
Input: accounts = [[1,2,3],[3,2,1]]
Output: 6
Explanation:
1st customer has wealth = 1 + 2 + 3 = 6
2nd customer has wealth = 3 + 2 + 1 = 6
Both customers are considered the richest with a wealth of 6 each, so return 6.

Example 2:
Input: accounts = [[2,8,7],[7,1,3],[1,9,5]]
Output: 17

3. **Attempt any two:**

(a) You have a long flowerbed in which some of the plots are planted, and some are not. However, flowers cannot be planted in adjacent plots. Given an integer array flowerbed containing 0's and 1's, where 0 means empty and 1 means not empty, and an integer n, return true if n new flowers can be planted in the flowerbed without violating the no-adjacent-flowers rule and false otherwise. (6)

Example :
Input: flowerbed = [1,0,0,0,1], n = 1 $\Longrightarrow$ Output: **True**
Input: flowerbed = [1,0,0,0,1], n = 2 $\Longrightarrow$ Output: false

(b) Given an n x n binary matrix image, flip it horizontally, then invert it, and return the resulting image. To flip an image horizontally means that each row of the image is reversed. For example, flipping [1,1,0] horizontally results in [0,1,1]. To invert an image means that each 0 is replaced by 1, and each 1 is replaced by 0. For example, inverting [0,1,1] results in [1,0,0]. (6)

Example :
Input: image = [[1,1,0],[1,0,1],[0,0,0]]
Output: [[1,0,0],[0,1,0],[1,1,1]]
Explanation: First reverse each row: [[0,1,1],[1,0,1],[0,0,0]].
Then, invert the image: [[1,0,0],[0,1,0],[1,1,1]]

(c) Given a $m \times n$ binary matrix mat, find the 0-indexed position of the row that contains the maximum count of ones, and the number of ones in that row. In case there are multiple rows that have the maximum count of ones, the row with the smallest row number should be selected. Print the index of the row, and the number of ones in it. (6)

Example 1:
Input: mat = [[0,0,0],[0,1,1]]
Output: [1,2]
Explanation: The row indexed 1 has the maximum count of ones (2). So we return its index, 1, and the count. So, the answer is [1,2]

Why did the programmer quit his job?
Because he didn't get arrays!