

CS593: Data structure and Database Lab
Take Home Assignment - 2 (10 Questions, 100 Points)

Submission Dead Line: 27-Aug-2021 23:59 Hours

Level: Easy

(3×5 = 15 points)

1. Given a string S containing alphabets and special character. Reverse the string without affecting the position special character.

Examples:

Input: pq#r\$st

Output: ts#r\$qp

Input: abc\$\$df#g

output: gfd\$\$cb#a

2. Given a string containing digit from 0-9 which represent a positive number. It is also given an integer n. You have to remove the n digit from the string so that resultant string represents the smallest positive integer without affecting the order of remaining digits.

Examples:

input: S = "645302" n = 2

output: "4302"

input S = "143726" n=2

output = "1326"

3. Given an integer array nums, return an array answer such that answer[i] is equal to the product of all the elements of nums except nums[i].

Example 1:

Input: nums = [1,2,3,4]

Output: [24,12,8,6]

Example 2:

Input: nums = [-1,1,0, -3,3]

Output: [0,0,9,0,0]

Level: Medium

(7.5× 2 = 15 points)

4. Write a program to maximum size rectangle binary sub-matrix with all 1s

Example:

Input:

0 1 1 0

1 1 1 1

1 1 1 1

1 1 0 0

Output:

8

Explanation:

The largest rectangle with only 1's is from

(1, 0) to (2, 3) which is

1 1 1 1

1 1 1 1

Input:

0 1 1

1 1 1

0 1 1

Output:

6

Explanation:

The largest rectangle with only 1's is from

(0, 1) to (2, 2) which is

1 1

1 1

1 1

5. Write a program to find all common elements present in each row of a matrix.

Input: M × N matrix

[7 1 3 5 3 6]

[2 3 6 1 1 6]

[6 1 7 2 1 4]

[6 6 7 1 3 3]

[5 5 6 1 5 4]

[3 5 6 2 7 1]

[4 1 4 3 6 4]

[4 6 1 7 4 3]

Output: The common elements are 1 and 6

Level: Advanced

(14× 5 = 70 points)

Note: Additional 6-point bonus for correct solution of Question no 10.

6. Given a 2-D array of pixels, with M rows and N columns, find the resulting image formed if the matrix is rotated by 90 degrees in clockwise direction. Consider all even and odd cases, with $1 \leq M, N \leq 10$

Example:

Input: [1 2 3]
 [4 5 6]

Output: [4 1]
 [5 2]
 [6 3]

Ex2

Input: [1 2 3 4 5]
 [6 7 8 9 0]
 [1 2 3 4 5]
 [6 7 8 9 0]

[1 2 3 4 5]

Output: [1 6 1 6 1]
[2 7 2 7 2]
[3 8 3 8 3]
[4 9 4 9 4]
[5 0 5 0 5]

7. Write a program to print the elements of a 2-D array of size M rows and N columns in a spiral order, starting from top left, in a clockwise order.

Example:

Input:

Given the following matrix:

[
[1, 2, 3],
[4, 5, 6],
[7, 8, 9]
]

Output:

[1, 2, 3, 6, 9, 8, 7, 4, 5]

Input: [1 2 3 4 5]
[6 7 8 9 0]
[1 2 3 4 5]
[6 7 8 9 0]
[1 2 3 4 5]

Output:

[1, 2, 3, 4, 5, 0, 5, 0, 5, 4, 3, 2, 1, 6, 1, 6, 7, 8, 9, 4, 9, 8, 7, 2, 3]

8. Count the number of peaks in a given 2-D array. An element is a peak at index [i][j] if $A[i][j] > A[i-1][j-1], A[i-1][j+1], A[i+1][j-1], A[i+1][j+1]$. Consider $1 \leq i, j \leq M-2$ for an $M \times M$ matrix [Do not consider the elements at the boundary of matrix, having row or column as 0 or $M-1$]. Return -1 if no peak exists.

Input:

[1 2 4 3 7]
[6 3 1 9 2]
[4 8 2 7 9]
[5 7 9 4 1]
[1 2 3 4 2]

Output:3

Explanation: The peak exists at $A[1][3]$, $A[2][1]$ and $A[3][2]$

9. Given a partial sudoku 5×5 board, determine if the board could be valid or not. A board is valid, if it has at least one solution, such that the element $A[i][j]$ appears exactly once in row i and column j.

Example:

Input:

[. 1 . . .]
[. . . 3 .]

```
[ . . 4 1 2 ]
[ 1 . . 5 . ]
[ 3 . . . 4 ]
```

Output:

True

Explanation: It has the following solution:

```
[ 2 1 3 4 5]
[ 4 2 5 3 1]
[ 5 3 4 1 2]
[ 1 4 2 5 3]
[ 3 5 1 2 4]
```

10. Given a 2-D Boolean array of size M*N, if an element is zero, set its entire row and column to zero, and return the matrix. 15 marks for solution, +5 bonus marks if you do it in-place [without using additional matrix].

Example:

Input:

```
[ 1 1 1]
[ 1 0 1]
[ 1 1 1]
```

Output:

```
[ 1 0 1]
[ 0 0 0]
[ 1 0 1]
```

Example 2:

Input:

```
[ 0 1 2 0]
[ 3 4 5 2]
[ 1 3 1 5]
```

Output:

```
[ 0 0 0 0]
[ 0 4 5 0]
[ 0 3 1 0]
```

Submission instruction

File Naming Convention: Create a directory with your roll number. Inside this directory, place all the programs and input files. Prefix the file name with your roll number followed by “_” followed by question number followed by “.c”. Example: 194161000_q1. c.

README.txt Write a short note on sequence of steps involved to run your programs. Include what is the input for the program (with an example) and what will be the output from the program (with an example).

tar gzip Create (roll number). tar.gz file using the above directory. This directory must contain the above program.

Submission Email the above tar gzip file to the CS593 head TA sujitkumar@iitg.ac.in as per the above given dead line.

Submission does not follow above file naming convention and instruction shall not be evaluated.

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Note: You can use c or CPP for implementation but please avoid using unnecessary library. Create your own data structure rather than using STL or another library. If you are of using such library your submission shall not be considered for evaluations.