Indian Statistical Institute

Semester-I 2023–2024

M.Tech.(CS) - First Year

Mock Test 1

Subject: Computing Laboratory

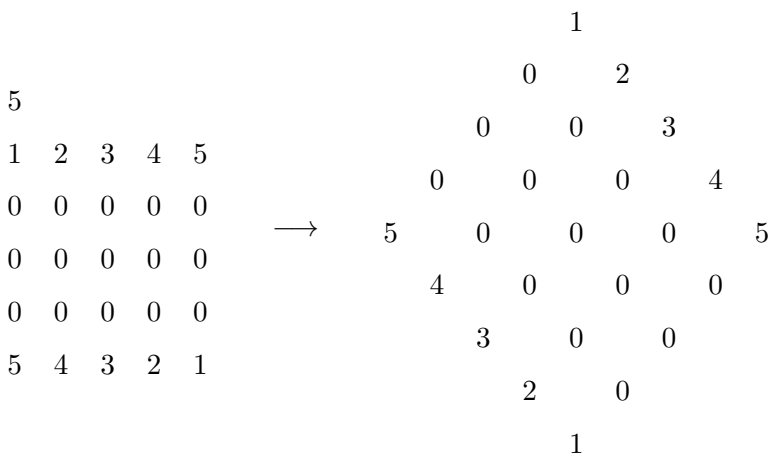
Duration: 3 hrs.

INSTRUCTIONS

1. You may consult or use slides / programs provided to you as course material, or programs that you have written yourself as part of classwork / homework for this course, but please **do not** consult or use material from other Internet sources, your classmates, or anyone else.
2. Please make sure that your programs adhere strictly to the specified input and output format. **Your program may not pass the test cases provided, if your program violates the input and output requirements.**
3. Submissions from different students having significant match will be **debarred from evaluation**.

NOTE: Unless otherwise specified, all programs should take the required inputs from stdin, and print the desired outputs to stdout.

Q1. Your input is a positive integer n, followed by an $n \times n$ square matrix A with each cell filled with a digit between 0 and 9. Write a program to display A in the terminal rotated clockwise at an angle of 45° as shown in the example below.



Q2. Suppose a file contains a sequence of k integers read in a row major fashion from an $n \times m$ matrix A. The dimensions n and m of the matrix are unknown. Write a program to print the possible values of the matrix A that can lead to the contents given in the file.

Input format: the number k itself, followed by the k matrix elements.

Output format: All the distinct matrices for which the given input sequence may be obtained. Successive matrices should be separated by a blank line. Matrices should be printed in increasing order of the number of rows.

Sample input 0: 4 1 3 5 6

Sample output 0:

```
1 3 5 6

1   3
5   6

1
3
5
6
```

Sample input 1: 6 2 5 3 7 2 5

Sample output 1:

```
2 5 3 7 2 5

2   5   3
7   2   5

2   5
3   7
2   5

2
5
3
7
2
5
```

Q3. You are given two arrays, A and B, each containing the same set S of n distinct integers. For a given $x \in S$, let $\text{index}_A(x)$ and $\text{index}_B(x)$ denote the position at which x occurs in A and B, respectively. Write a program to find the element y of S for which

$$\textit{displacement}(y) \triangleq |\text{index}_A(y) - \text{index}_B(y)|$$

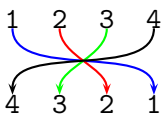
is maximum. If there are multiple ys all of which have the same maximum displacement value, your program should select the **smallest** y.

Input format: Your program should read n from stdin, followed by the elements of A and the elements of B in order.

Output format: Your program should print 3 space-separated integers: y, $\text{index}_A(y)$ and $\text{index}_B(y)$, where y is as defined above. The 3 integers should be printed on a single line.

Sample input:

```
4
0  1  2  3        ⟵ indices (not part of the input)
1  2  3  4        ⟵ elements of A
4  3  2  1        ⟵ elements of B
```



Sample output:

```
1 0 3
```

Explanation: The displacement for both `1` and `4` is 3, while the displacement for `2` and `3` is 1. Thus, the maximum displacement is observed for elements `1` and `4`. Of these, `1` is the smaller value (y); it occurs at index `0` and `3` in arrays A and B, respectively.

NOTE: For now, it is enough to solve this using any simple method that you can think of. Later, we will consider the question of how to solve the problem efficiently.