**CS1020E | Lab 2 | Exercise 2**

**Matrix Transformation**

**Objective**

The objective of this exercise is to practice basic OOP programming by defining and using simple classes.

**Problem Description**

Given a 2-dimensional square matrix, output the final state of the matrix after performing the given sequence of transformation operations. The followings are the valid operations:

1. **Rotate** *X*

- Rotate the matrix by *X* degrees clockwise, and *X* can only be 90, 180, or 270.

2. **Reflect x**

- Reflect the matrix about the *x*-axis.

3. **Reflect y**

- Reflect the matrix about the *y*-axis.

In your program, you may want to read each input transformation operation into a string object, and you can compare the value in the string object to a string literal using the == operator, such as the followings:

string testStr;

cin >> testStr;

if (testStr == "Good") ...

For more info about the string class, see <http://www.cplusplus.com/reference/string/string/>.

**Inputs**

The first line of the input contains one integer *N*, where 1 <= *N* <= 100. The next *N* lines contain the *N* x *N* integers of the matrix.

The next line is an integer *K*, where 1 <= *K* <= 100, and it is the number of transformation operations to be performed.

Each of the subsequent *K* lines is the operation “**Rotate** *X*” (where is *X* is 90, 180 or 270), “**Reflect x**”, or “**Reflect y**”.

**Outputs**

The output is the final state of the matrix after the given sequence of transformation operations.

**Sample Input**

**3**

**1 2 3**

**4 5 6**

**7 8 9**

**3**

**Rotate 90**

**Reflect x**

**Reflect y**

(*User inputs are shown in* ***bold red****.*)

**Sample Output**

3 6 9

2 5 8

1 4 7

**Explanation of Sample Output**

1. Initial matrix:

1 2 3

4 5 6

7 8 9

2. After 90 degrees rotation:

7 4 1

8 5 2

9 6 3

3. After reflection about the *x*-axis:

9 6 3

8 5 2

7 4 1

4. After reflection about the *y*-axis:

3 6 9

2 5 8

1 4 7

**Submission**

You need to submit only your completed **Matrix.cpp**, **Matrix.h**, and **Transformation.cpp** to CodeCrunch (<https://codecrunch.comp.nus.edu.sg/>) before the specified deadline. We will take only your latest submission.

Late submissions will not be accepted. The submission system in CodeCrunch will automatically close at the deadline.