Introduction to Programming and Data Structures

Homework 0: Matrix Transformer

This homework is not for a grade, but is encouraged to be completed.

OVERVIEW

In this assignment, you will write a C++ program that manipulates a 2D matrix of integers. Your program will read an initial matrix and a sequence of transformation commands from a file. It will then apply these transformations in order and print the resulting matrix to an output file.

This problem will test your understanding of 2D arrays, file I/O, and basic loop structures for data manipulation.

INPUT

Your program will read from an input file specified as a command-line argument. The input file will be structured as follows:

1. The first line contains two integers, R and C, representing the number of rows and columns in the initial matrix, separated by a space.
2. The next R lines will each contain C integers, separated by spaces, representing the matrix.
3. The final line will contain a sequence of transformation commands, separated by spaces.

Transformation Commands:

- FLIP_H: Flips the matrix **horizontally**. The first column becomes the last, the second becomes the second-to-last, and so on.
- FLIP_V: Flips the matrix **vertically**. The first row becomes the last, the second becomes the second-to-last, and so on.
- ROTATE_R: Rotates the matrix **90 degrees clockwise**. An R x C matrix will become a C x R matrix.

You can assume all inputs will be in the correct format. For simplicity, you are welcome to use a temporary 2D array to store the result of a transformation before updating the main matrix.

Example Input (input1.txt):

```
3 4
1 2 3 4
5 6 7 8
9 10 11 12
FLIP_V ROTATE_R
```

OUTPUT

Your program should write the final state of the matrix to an output file after all transformations have been applied sequentially.

Processing the Example:

1. **Initial Matrix:**
   1 2 3 4
   5 6 7 8
   9 10 11 12

2. **After FLIP_V:**
   9 10 11 12
   5 6 7 8
   1 2 3 4

3. **After ROTATE_R (applied to the result of FLIP_V):**
   1 5 9
   2 6 10
   3 7 11
   4 8 12

Corresponding Output for input1.txt:

1 5 9
2 6 10
3 7 11
4 8 12

RESOURCES & SUBMISSION

Please refer to the course website for detailed instructions on how to compile, test, and submit your homework on the server.

- **General Homework Information & Submission:** https://uh.edu/nouhadrizk/about/courses/programming-and-data-structures/homework/
- **Testing Your Program:** https://uh.edu/nouhadrizk/about/courses/programming-and-data-structures/homework/homework-introduction/

You must submit your C++ source files (.cpp and any .h files you create) to the server under your root directory. Create a folder named **hw0** (case-sensitive) and place your files inside it.

ACADEMIC INTEGRITY

This is an individual assignment. All work submitted must be your own. Your submission will be automatically checked for plagiarism against other students' submissions and external sources. Any detected instances of copying or cheating will result in a grade of **0** for the assignment and may lead to further disciplinary action. We encourage you to discuss concepts with your peers, but the code you write must be entirely your own.