CSCI 2500 —- Computer Organization
Homework 01 —- Due Friday, January 26, 2024

Overview

- This homework is due by 11:59pm EDT on the above date via a Submitty gradeable named *"Homework 01"*.
- This homework is to be completed individually. Do not share your solutions with anyone else.
- Homework assignments are available approximately seven calendar days before they are due.
- Plan to start each homework early. You can ask questions during office hours, in the Submitty forum, and during your lab session.
- You **must** use C for this homework assignment, and your code must successfully execute on Submitty to obtain full credit.

Homework Specifications

In this homework, you will write a program to perform 2-D square matrix multiplication. For the first operand (matrix), your program reads a matrix of doubles from a file. The name of the file is provided on the command line (i.e. argv[1]). For the second operand (matrix), your program should generate the swapped version of the first matrix. The swap matrix operation is implemented as follows: the ith column is exchanged/swapped with the contents of the i+2 column. So, column 0 is swapped with column 2 and column 1 is swapped with column 3 and so on until all columns are swapped up to column N − 1 for an N-by-N matrix. The following figure shows one example input and its swapped version.

```
The Input Matrix:
/******** START of 2-D Matrix ***************************************************************************
1.000000        2.000000        3.000000        4.000000
5.000000        6.000000        7.000000        8.000000
9.000000        10.000000       11.000000       12.000000
13.000000       14.000000       15.000000       16.000000
/******** END of 2-D Matrix *****************************************************************************

Output of Swap Matrix
/******** START of 2-D Matrix ***************************************************************************
3.000000        4.000000        1.000000        2.000000
7.000000        8.000000        5.000000        6.000000
11.000000       12.000000       9.000000        10.000000
15.000000       16.000000       13.000000       14.000000
/******** END of 2-D Matrix *****************************************************************************
```

The input file

The input file contains the size of the square matrix N (N-by-N) in the first line. The subsequent lines each hold one matrix element. For example for the following matrix:

1.0 2.0 3.0
4.0 5.0 6.0
7.0 8.0 9.0

the data is stored in the input file as follows:

3
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0

You may assume only valid input files are passed to your program. Three test input files are supplied with your homework assignment. You may use them for reference.

You only need to submit your source file that contains the main function along with all other functions defined. You should use the format in the *frame.txt* file. For every function, the required information is provided as comments. The function declaration is also provided in the frame.txt file.

The resulting matrix should be written to the output file in the format just like the input file.

Memory Leak Detection

Since you will use dynamic memory allocation, it is important not to have any memory leaks. You can do this check in the final steps of your homework. Type the following command when you want to execute your program and `Valgrind` checks your executable to find any memory leaks. You should have 0 memory leaks to pass this check. You should not have any memory leaks if you properly free the memory you allocated during your program.

```
prompt$ valgrind --leak-check=full ./<nameOfExecutable> <inputFile.mat>
```

Submission Instructions

Before you submit your code, be sure that you have clearly commented your code (this should not be an after-thought). Further, your code should have a clear and logical organization.

To submit your assignment (and also perform final testing of your code), please use Submitty.

Also as a reminder, your code must successfully execute on Submitty to obtain credit for this assignment.