

CS 3035, Fall 2022

In-Lab Exercise 8

Due: September 16, 2022 (11:59 PM midnight)

The following programming exercise has two parts. Part 1 is compulsory for everyone and part 2 is optional for those who might want to attempt it. Please submit a zip/tar compressed file containing the following:

1. Your program for Parts 1 (and Part 2 if you attempted it). Both text file (.txt) or a C program file (.c) are acceptable.
2. A file with screenshot of your outputs for each part. Please submit this file as a PDF.

Part 1: Matrix addition, subtraction, and transpose

Please write a C program that first allows you to initialize two 3×3 matrices, A and B. Then, write three functions, matrixAdd, matrixSubtract, and matrixTranspose, that can do the following operations and print their result row-wise to standard output. Please ensure that your program can handle negative array elements also.

- matrixAdd: accepts three 3×3 matrices A, B, and SUM as arguments to the function. It adds A and B and returns their sum. The sum is stored in matrix SUM.

Matrix addition of two matrices is the pair-wise addition of corresponding elements:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} + \begin{pmatrix} 0 & 1 \\ 2 & 0 \end{pmatrix} = \begin{pmatrix} 1 & 3 \\ 5 & 4 \end{pmatrix}$$

- matrixSubtract: accepts three 3×3 matrices A, B, and DIFF as arguments to the function. It subtracts B from A and returns the difference. The difference is stored in matrix DIFF.

Matrix subtraction of two matrices is the pair-wise subtraction of corresponding elements:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} - \begin{pmatrix} 0 & 1 \\ 2 & 0 \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 1 & 4 \end{pmatrix}$$

- matrixTranspose: accepts two 3×3 matrix, A/B (your choice) and TRANS as arguments to the function and returns the transpose of the input matrix (A/B). The transpose is stored in TRANS.

Matrix transpose of a given matrix is the flipped version of the matrix. We can transpose a matrix by switching its rows with its columns:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \rightarrow \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$$

Part 2: Matrix multiplication

Extend the program from Part 1 with one additional function called matrixMultiply. This function accepts three 3×3 matrices A, B, and PROD as arguments to the function. It multiplies A and B and returns the product. The product is stored in matrix PROD.

Matrix multiplication is done using a DOT PRODUCT. Please refer to the following example:

$$\begin{pmatrix} 1 & 7 \\ 2 & 4 \end{pmatrix} \times \begin{pmatrix} 3 & 3 \\ 5 & 2 \end{pmatrix} = \begin{pmatrix} (1 \times 3 + 7 \times 5) & (1 \times 3 + 7 \times 2) \\ (2 \times 3 + 4 \times 5) & (2 \times 3 + 4 \times 2) \end{pmatrix}$$