

# CMPSC 140 Summer 2022: Programming Assignment 0, Matrix Multiply in C

Instructor: Richard Boone

Due: July 8th, 2022 9 PM

**Purpose:** This assignment is meant for you to familiarize yourself with some basic concepts in C: arrays, pointers, and some simple I/O which should help familiarize you with differences from C++. Additionally, this assignment should help you get used to using makefiles in C, and help you to understand caches and storage ordering in matrices in C.

**Assignment:** The zip file available on Gauchospace provides a template for performing a matrix multiply operation in C, including the necessary makefile and a set of files for performing and testing the matrix multiply. You have three tasks as follows;

1. Edit the `matrix_multiply.c` file to implement the five other possible orderings for a matrix multiply. These are defined in the `matrix_multiply.h` file. You simply need to implement them.
2. Edit the `testbed.c` file to allow for testing of all different orderings that you created in the matrix multiply file.
3. Test the time taken to complete a matrix multiply with all six orderings for square matrices of the following side sizes: [4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048]. *Note: While total computation time should not be too excessive, the largest matrices with the worst orderings can take up to 10 minutes to complete. Please allow time for this when planning when you will work on the project*

For your report, please include two tables. One with all times taken, and one with average floating point operations per second (FLOPS) for all tests. Additionally, include three graphs. All problem sizes should be on a log scale:

1. Graph problem size against time taken for your fastest algorithm
2. Graph problem size against FLOPS for all algorithms
3. Graph problem size against FLOPS for your fastest and slowest algorithm

Finally, write a paragraph describing what makes some orderings faster than other, and describing why your fastest ordering is the best.

Submit all of the above in a pdf to gradescope, with your two edited code files attached to the pdf at the end. Note: when included with the rest of the given code, and run on CSIL, the files should run with no errors. If we need to run your code and it either does not compile or gives an error while running, you may lose points

**Turn in Instructions:** Please turn in the homework via gradescope by 9 PM on Friday July 8th, 2022. For this programming assignment you will be allowed to submit in pairs. If you are submitting with a partner, please link your partner on your Gradescope submission.