ELEC 374

Machine Problem 2

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# Academic Integrity

“I do hereby verify that this machine problem submission is my own work and contains my own

original ideas, concepts, and designs. No portion of this report or code has been copied in whole

or in part from another source, with the possible exception of properly referenced material".

# Code

Text

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Description automatically generated A screenshot of a computer

Description automatically generated with medium confidence

# Output Screenshots

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Description automatically generated

# Results

Table 1: Table of the run times of each method for each matrix size, over an average of 4 runs.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 125x125 | 250x250 | 500x500 | 1000x1000 | 2000x2000 |
| Host Time | 0.153 | 0.595 | 2.408 | 9.52 | 39.863 |
| Normal GPU Matrix Addition | 0.068 | 0.02 | 0.05 | 0.16 | 0.583 |
| Row Addition | 0.08 | 0.133 | 0.245 | 0.47 | 1.79 |
| Column Addition | 0.108 | 0.195 | 0.455 | 0.888 | 3.44 |

Table 2: Each of the 4 runs that was used to find the averages above.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Run** **1** | | | | |
| 0.14 | 0.52 | 2.48 | 9.87 | 39.05 |
| 0.07 | 0.02 | 0.05 | 0.16 | 0.58 |
| 0.08 | 0.13 | 0.24 | 0.47 | 1.79 |
| 0.11 | 0.2 | 0.45 | 0.89 | 3.43 |
| **Run 2** | | | | |
| 0.16 | 0.61 | 2.12 | 8.58 | 40.43 |
| 0.05 | 0.02 | 0.05 | 0.16 | 0.58 |
| 0.08 | 0.13 | 0.24 | 0.46 | 1.79 |
| 0.11 | 0.19 | 0.45 | 0.88 | 3.44 |
| **Run 3** | | | | |
| 0.17 | 0.61 | 2.46 | 9.8 | 39.76 |
| 0.08 | 0.02 | 0.05 | 0.16 | 0.59 |
| 0.08 | 0.14 | 0.25 | 0.48 | 1.8 |
| 0.11 | 0.2 | 0.46 | 0.89 | 3.44 |
| **Run 4** | | | | |
| 0.14 | 0.64 | 2.57 | 9.81 | 40.21 |
| 0.07 | 0.02 | 0.05 | 0.16 | 0.58 |
| 0.08 | 0.13 | 0.25 | 0.47 | 1.78 |
| 0.1 | 0.19 | 0.46 | 0.89 | 3.43 |

Figure 1: Average run time of all 4 matrix addition methods.

# Analysis

It appears that for smaller size matrices, such as 125x125, the host is able to compute matrix addition fairly quickly, keeping up with the GPU. However, when the sizes increase, the host simply lacks the computational power to keep up with the GPU. Based on results above, it can be seen that for any matrices above 125x125, the GPU should be used to avoid unnecessarily long computation times.

As for the three different methods of performing GPU matrix addition, performing it by individual thread appears to be the quickest and most stable method when compared against row and column addition. The row addition appears to be slightly quicker than column addition, but as sizes increase, both methods take longer that normal GPU matrix addition. Row addition tends to be faster because consecutive threads access consecutive elements in memory, leading to coalesced memory access, which is overall faster. Despite this, all three methods passed the tests, and the values were transferred correctly.