CS3310-03 F21 Project 1

Due date: 11:59PM, Sunday, October 31

30 pts

Program in Java or C++ the following algorithms that we covered in the class:

1. Classical matrix multiplication

2. Naive divide-and-conquer matrix multiplication

3. Strassen's matrix multiplication

Let the matrix size be $n \times n$. You can assume n is a power of 2. Carry out a complete test of your algorithms with $n = 2, 4, 8, 16, 32, 64, 128, 256, ...$ (up to the largest size of n that your computer can handle). In order to obtain more accurate results, the algorithms should be tested many times with the same matrix. The total time spent is then divided by the number of times the algorithm is performed to obtain the time taken to solve the given instance.

Write a detailed report together with graphs explaining the data sets, test strategies and explanation of the results. What are the theoretical complexity comparisons of the three algorithms ? Is one algorithm always faster than the others ? Conclude your report with the strength and constraints of your work.

Sanity check: Compute the product:

$$
\begin{bmatrix}
2 & 0 & -1 & 6 \\
3 & 7 & 8 & 0 \\
-5 & 1 & 6 & -2 \\
8 & 0 & 2 & 7
\end{bmatrix}
\cdot
\begin{bmatrix}
0 & 1 & 6 & 3 \\
-2 & 8 & 7 & 1 \\
2 & 0 & -1 & 0 \\
9 & 1 & 6 & -2
\end{bmatrix}
$$

Output the result matrix and include a screenshot in your report (for all three algorithms).

Extra credit. *3 pts* if your program can handle any value of n. Explain in a separate paragraph the method you use. Does it affect the theoretical comparisons and the empirical comparisons ?

Submission. Your report has to be typed. Also, include your code and screenshots of the results at the end of the report in one pdf file. To submit the project, you need to upload the pdf file to Gradescope. If you do it with a partner, you need to put two names on the assignment and submit it as a group assignment.

Late submission will be accepted with a penalty of 10% per calendar day.

Academic integrity. Discussions among students are encouraged, but you are only allowed to share code and report with your partner (if you work in group). You are responsible for doing your own work and for insuring that your work is protected from copying. The University's policy on Academic Integrity, as stated in the catalog, will be enforced.