Block recursive matrix multiplication

PROGRAMMING PROBLEM I

CS 3513

Due: February 10, 4:30 p.m.

Description: The programming problem is to use recursive block subdivision to implement an outer product form of matrix multiplication.

Details: Your program should be calll `rbmm` and take three commandline parameters:

`rbmm` *infileA infileB outFileC*

which are the filenames of the data files containing the values for matrices **A** and **B**; and the location to store matrix **C = AB**. The filenames will be placed as commandline arguments. **Do not prompt for filenames.**

- Each matrix **A** and **B** should be divided in 2x2 blocks that are conforming for multiplication with each dimension cut in one half (approximately with integer rounding).
- The outer product form of matrix multiplication should be implemented. That is,

$$\begin{aligned}\mathbf{C} = \mathbf{AB} &= \begin{bmatrix}\mathbf{A}_{00} & \mathbf{A}_{01}\\ \mathbf{A}_{10} & \mathbf{A}_{11}\end{bmatrix}\begin{bmatrix}\mathbf{B}_{00} & \mathbf{B}_{01}\\ \mathbf{B}_{10} & \mathbf{B}_{11}\end{bmatrix}\\ &= \begin{bmatrix}\mathbf{A}_{00}\\ \mathbf{A}_{10}\end{bmatrix}\begin{bmatrix}\mathbf{B}_{00} & \mathbf{B}_{01}\end{bmatrix} + \begin{bmatrix}\mathbf{A}_{01}\\ \mathbf{A}_{11}\end{bmatrix}\begin{bmatrix}\mathbf{B}_{10} & \mathbf{B}_{11}\end{bmatrix}\\ &= \begin{bmatrix}\mathbf{A}_{00}\mathbf{B}_{00} & \mathbf{A}_{00}\mathbf{B}_{01}\\ \mathbf{A}_{10}\mathbf{B}_{00} & \mathbf{A}_{10}\mathbf{B}_{01}\end{bmatrix} + \begin{bmatrix}\mathbf{A}_{01}\mathbf{B}_{10} & \mathbf{A}_{01}\mathbf{B}_{11}\\ \mathbf{A}_{11}\mathbf{B}_{10} & \mathbf{A}_{11}\mathbf{B}_{11}\end{bmatrix}\end{aligned}$$

- Recurse on block multiplication until the dimensions of the blocks are of size one or two, in which case the multiplication is calculated explicitly.
- Data files are line based text files with one row of the matrix per line. The files use whitespace separation. The matrix values will be floating point values. Each row should have the same number of values. Store the calculated matrix **C** in the same format as the input files.
- If the matrices are not conforming (dimensions are incompatible for multiplication), print out an error message.

Submit all source code files using subversion or D2L. Also submit a readme.txt file. The readme file should describe all known bugs that were not removed from the program and discuss problems encountered when developing and testing the program. The readme file should describe the programming language, complier version, OS environment, and all necessary steps to compile and execute your code. Non-standard libraries should be submitted with the code. You may assume that numpy (for python), eigen (for C++), and jama (for java) are all ready installed. Any external sources of information should be explicitly mentioned in the readme.txt and in the comments of the source code.