CS518A: Parallel EDA
Homework #1

Please write two computer programs which perform the following matrix multiplication operation:

$$C_{l \times n} = A_{l \times m} \bullet B_{m \times n}$$

where

$$C = \begin{bmatrix} c_{1,1} & c_{1,2} & \cdots & c_{1,n} \\ c_{2,1} & c_{2,2} & \cdots & c_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ c_{l,1} & c_{l,2} & \cdots & c_{l,n} \end{bmatrix}_{l \times n} , \quad A = \begin{bmatrix} 1 & 1 & \cdots & 1 \\ 2 & 2 & \cdots & 2 \\ \vdots & \vdots & \ddots & \vdots \\ l & l & \cdots & l \end{bmatrix}_{l \times m} , \text{ and } B = \begin{bmatrix} 1 & 2 & \cdots & n \\ 1 & 2 & \cdots & n \\ \vdots & \vdots & \ddots & \vdots \\ 1 & 2 & \cdots & n \end{bmatrix}_{m \times n} .$$

Requirements:
  (a) One program is a sequential program, and the other is a shared-memory parallel program.
  (b) Both programs must allow users to type/choose values of l, m, and n before performing the multiplication $A_{l \times m} \bullet B_{m \times n}$.
  (c) The sequential program must be implemented in C/C++, while the shared-memory parallel program must be implemented in C/C++ with OpenMP. (Please use gcc or g++ to compile both programs.)
  (d) Please verify the correctness of the two programs by printing matrices A, B, and C on the screen. You may wish to give arbitrary values of l, m, and n, and then verify the multiplication results.
  (e) Please write a report (2~4 pages) which contains the followings:
    ➢ Explanations of your algorithm(s) and/or source code (How do you parallelize the matrix multiplication operation?)
    ➢ A chart which shows the relationship between <u>the parallel program's execution time</u> and <u>the number of threads used</u>. You may wish to suppress the program's functionality of printing matrices A, B, and C on the screen.
    ➢ Comparisons of the performance between the sequential program and the parallel program. You may wish to suppress the programs' functionality of printing matrices A, B, and C on the screen.

Deadline: Tuesday, October 6th, 2009