Connor Beardsmore - 15504319

Semester 1, 2016

OS200 Assignment

Purpose

Implementation of a matrix multiplication calculator in C99. The data from the two matrices to mutiply are read from file with the matrix elements being space seperated. The calculator outputs the subtotal of every row, plus the total of all the row subtotals combined. Part A utilizes Multiprocessing and Part B utilizes Multithreading. Shared memory is established via POSIX's shm_open(). Synchronization is ensured via the use of POSIX semaphores, mutexes and conditions.

File List

```
.c FILES
--------
pmms.c
fileIO.c

.h FILES
--------
pmms.h
fileIO.h

OTHER
-----
Makefile
README.md
/testFiles
```

Instructions to Compile + Run

To Compile:

```
make
```

To Run:

```
./pmms [file A] [file B] [M] [N] [K]
```

To Clean:

```
make clean
```

where:

- file A = Matrix A Filename
- file B = Matrix B Filename
- M = Matrix A Rows
- N = Matrix A Columns / Matrix B Rows
- K = Matrix B Columns

Matrix Multiplication

The product matrix C's elements of muliplying matrix A with matrix B is as follows:

$$C_{i,j} = \sum_{r=1}^{N} A_{i,r} B_{r,j}$$

The image below illustrates an example of this calculation:

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}, \text{ we compute}$$

$$C = A \times B = \begin{bmatrix} 1\times1 + 2\times5 & 1\times2 + 2\times6 & 1\times3 + 2\times7 & 1\times4 + 2\times8 \\ \mathbf{3\times1 + 4\times5} & \mathbf{3\times2 + 4\times6} & \mathbf{3\times3 + 4\times7} & \mathbf{3\times4 + 4\times8} \\ 5\times1 + 6\times5 & 5\times2 + 6\times6 & 5\times3 + 6\times7 & 5\times4 + 6\times8 \end{bmatrix}$$

$$= \begin{bmatrix} 11 & 14 & 17 & 20 \\ \mathbf{23} & \mathbf{30} & \mathbf{37} & \mathbf{44} \\ 35 & 46 & 57 & 68 \end{bmatrix}$$