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OS200 Assignment

Purpose

Implementation of a matrix multiplication calculator in C. The data from the two matrices to mutiply are read from file. The calculator outputs the subtotal of every row, plus the grand 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]
```

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:

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

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

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

References

Silberschatz, Abraham, Peter B. Galvin, and Greg Gagne. *Operating System Concepts*. 9th ed. Reading, MA: Addison-Wesley, 1994.