

CS3523: OS-II - ASSIGNMENT 1

Aim: The aim of this assignment is to understand how matrix multiplication task varies (in terms of speed of execution and sharing matrix data) in single-threaded, multi-threaded and multi-process programming fashion.

Problem: Write a program `matmul.c` that calculates $C=A*B$ where A is an integer matrix of size $ar*ac$ and B is an integer matrix of size $br*bc$. Variables `ar`, `ac`, `br`, and `bc` will be passed as mandatory arguments viz., `--ar`, `--ac`, `--br`, `--bc` respectively from command line and your program should first check feasibility of multiplication and report error if it's not possible. Run the computation in single process/thread, multi-thread, and multi-process variants respectively in a separate sub-routine for modularity. The program should have a routine named `init_matrix(...)` to initialize matrices A and B by making use of pseudo random number generator (`rand(...)` function) available in the standard C library in `<stdlib.h>`.

Also implement command line option `--interactive` to run the program in interactive mode. For interactive mode, write two more routines named `input_matrix(...)` and `output_matrix(...)` to input and display the contents of a given matrix in rectangular format. These two routines need to be called only in interactive mode.

Syntax:

```
matmul --ar <rows_in_A> --ac <cols_in_A> --br <rows_in_B> --bc <cols_in_B>
[--interactive]
```

Eg 1 - Non interactive mode.

```
./matmul --ar 3 --ac 4 --br 4 --bc 5
```

Output specification:

```
Time taken for single threaded: 400 us
Time taken for multi process: 300 us
Time taken for multi threaded: 200 us
Speedup for multi process : 1.33 x
Speedup for multi threaded : 2 x
```

Eg 2 - Interactive mode.

```
./matmul --ar 3 --ac 3 --br 3 --bc 3 --interactive
```

Input/Output specification

Enter A:

2 3 4

4 3 4

5 3 7

Enter B:

1 0 0

0 1 0

0 0 1

Result:

2 3 4

4 3 4

5 3 7

Enter A:

2 3 4

4 3 4

5 3 7

Enter B:

1 0 0

0 1 0

0 0 1

Result:

2 3 4

4 3 4

5 3 7

Enter A:

2 3 4

4 3 4

5 3 7

Enter B:

1 0 0

0 1 0

0 0 1

Result:

2 3 4

4 3 4

5 3 7

Time taken for single threaded: 400 us

Time taken for multi process: 300 us

Time taken for multi threaded: 200 us

Speedup for multi process : 1.33 x

Speedup for multi threaded : 2 x