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Programming Homework #2 Report

EE/CSCI 451

How to run my program:

To run the program, you navigate to the folder with all the files and type “make” from the command line. This should make all the programs. You can then run each program simply by typing its executable name:

P1 -> p1

P2 -> p2

P3 -> p3a, p3b

For p1 and p2 you need to enter a value for the number of threads. The command needs to be of the form: “p1 4”

Problems:

1.) Parallel Matrix Multiplication

*** The results shown here were produced on my local machine with n=1024 for the matrix dimensions. ***

Number of Threads	Execution time (ns)
1	13297505000
4	6436080000
16	6403057000
64	5541422000
256	5068085000

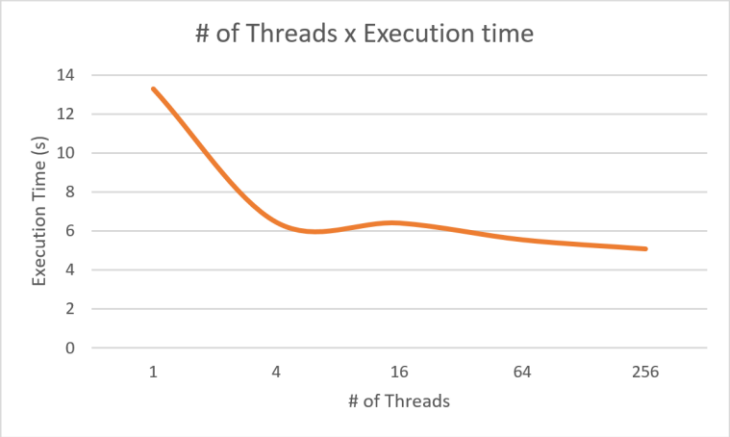
```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p1 1
Number of FLOPs = 2.14748e+009; Execution time = 13297505000 nanoseconds; MFLOPs per sec = 161.495
C[100][100]=6.26176e+007

C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p1 4
Number of FLOPs = 2.14748e+009; Execution time = 6436080000 nanoseconds; MFLOPs per sec = 333.663
C[100][100]=6.26176e+007

C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p1 16
Number of FLOPs = 2.14748e+009; Execution time = 6403057000 nanoseconds; MFLOPs per sec = 335.384
C[100][100]=6.26176e+007

C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p1 64
Number of FLOPs = 2.14748e+009; Execution time = 5541422000 nanoseconds; MFLOPs per sec = 387.533
C[100][100]=6.26176e+007

C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p1 256
Number of FLOPs = 2.14748e+009; Execution time = 5068085000 nanoseconds; MFLOPs per sec = 423.727
C[100][100]=6.26176e+007
```



2.) Parallel K-Means

Number of Threads	Execution time (ns)
1	1278006000
4	1877337000
8	1861825000

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p2 1
check
Execution time = 1278006000 nanoseconds

C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p2 4
check
Execution time = 1877337000 nanoseconds

C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p2 8
check
Execution time = 1861825000 nanoseconds
```

It seems that there's a slight slowdown from a serial to multithreaded implementation, and then negligible speedup from 4 threads to 8 threads. This could be due to the overhead of setting variables for each thread which increases with the number of threads.

3.) Producer-Consumer

a. Part a (not the full output)

i.

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p3a
Producer has put 2 cookies; # cookies on shelf changes from 0 to 2.
Producer has put 2 cookies; # cookies on shelf changes from 2 to 4.
Producer has put 2 cookies; # cookies on shelf changes from 4 to 6.
Producer has put 2 cookies; # cookies on shelf changes from 6 to 8.
Producer has put 2 cookies; # cookies on shelf changes from 8 to 10.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 10 to 9.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 9 to 8.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 8 to 7.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 7 to 6.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 6 to 5.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 5 to 4.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 4 to 3.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 3 to 2.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 2 to 1.
Producer has put 2 cookies; # cookies on shelf changes from 1 to 3.
Producer has put 2 cookies; # cookies on shelf changes from 3 to 5.
Producer has put 2 cookies; # cookies on shelf changes from 5 to 7.
Producer has put 2 cookies; # cookies on shelf changes from 7 to 9.
Producer has put 1 cookie; # cookies on shelf changes from 9 to 10.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 10 to 9.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 9 to 8.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 8 to 7.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 7 to 6.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 6 to 5.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 5 to 4.
```

b. Part b (not the full output)

i.

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 2\PHW 2\workspace>p3b
Producer has put 2 cookies; # cookies on shelf changes from 0 to 2.
Consumer 2 has taken 1 cookie; # cookies on shelf changes from 2 to 1.
Producer has put 2 cookies; # cookies on shelf changes from 1 to 3.
Producer has put 2 cookies; # cookies on shelf changes from 3 to 5.
Producer has put 2 cookies; # cookies on shelf changes from 5 to 7.
Producer has put 2 cookies; # cookies on shelf changes from 7 to 9.
Producer has put 1 cookie; # cookies on shelf changes from 9 to 10.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 10 to 9.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 9 to 8.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 8 to 7.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 7 to 6.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 6 to 5.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 5 to 4.
Consumer 2 has taken 1 cookie; # cookies on shelf changes from 4 to 3.
Consumer 2 has taken 1 cookie; # cookies on shelf changes from 3 to 2.
Consumer 2 has taken 1 cookie; # cookies on shelf changes from 2 to 1.
Producer has put 2 cookies; # cookies on shelf changes from 1 to 3.
Producer has put 2 cookies; # cookies on shelf changes from 3 to 5.
Producer has put 2 cookies; # cookies on shelf changes from 5 to 7.
Producer has put 2 cookies; # cookies on shelf changes from 7 to 9.
Producer has put 1 cookie; # cookies on shelf changes from 9 to 10.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 10 to 9.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 9 to 8.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 8 to 7.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 7 to 6.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 6 to 5.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 5 to 4.
Consumer 1 has taken 1 cookie; # cookies on shelf changes from 4 to 3.
```