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Programming Homework #1 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.

Naïve Matrix Multiplication -> p1a

Block Matrix Multiplication -> p1b

K-Means -> p3

Estimating Pi -> p4

For p1b you need to also enter a value for b from the command line. The command needs to be of the form: “p1b 4” (or 8, or 16).

Problems:

2.1 Naïve Matrix Multiplication

** I was unable to reserve a node to run my program so I instead ran them on my local machine. N=4096 ran for 15-20 minutes without completing, so I instead set n=1024 and have listed my results for this calculation instead. **

For n = 1024...

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 1\workspace>p1a
Number of FLOPs = 2.14748e+009; Execution time = 17086665000 nanoseconds; MFLOPs per sec = 125.682
C[100][100]=6.26176e+007
```

2.2 Block Matrix Multiplication

For n = 1024...

b = 4:

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 1\workspace>p1b 4
Number of FLOPs = 2.14748e+009; Execution time = 22242360000 nanoseconds; MFLOPs per sec = 96.5493
C[100][100]=6.26176e+007
```

b = 8:

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 1\workspace>p1b 8
Number of FLOPs = 2.14748e+009; Execution time = 14732020000 nanoseconds; MFLOPs per sec = 145.77
C[100][100]=6.26176e+007
```

b = 16:

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 1\workspace>p1b 16
Number of FLOPs = 2.14748e+009; Execution time = 7855641000 nanoseconds; MFLOPs per sec = 273.368
C[100][100]=6.26176e+007
```

Observations:

It seems that the block matrix multiplication was slightly faster than the naïve matrix multiplication. Additionally, as the block size was increased, the execution time of the computation decreased.

3. K-Means Algorithm

Input:



Output:



```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 1\workspace>p3
Execution time = 293227000 nanoseconds
```

4. Estimating Pi

| Number of Points | Value of Pi | Execution Time |
|------------------|-------------|----------------|
| 100 | 3.28 | 1017000 ns |
| 1000 | 3.184 | 1504000 ns |
| 10000 | 3.1444 | 12898000 ns |
| 100000 | 3.14592 | 40032000 ns |
| 1000000 | 3.14113 | 252319000 ns |

```
C:\Users\Kevin\Documents\Academic\USC\Y4S2\EE 451\PHW 1\workspace>p4
With 100 points...
Execution time = 1017000 nanosecs
Pi ~ 3.28

With 1000 points...
Execution time = 1504000 nanosecs
Pi ~ 3.184

With 10000 points...
Execution time = 12898000 nanosecs
Pi ~ 3.1444

With 100000 points...
Execution time = 40032000 nanosecs
Pi ~ 3.14592

With 1000000 points...
Execution time = 252319000 nanosecs
Pi ~ 3.14113
```