Course: ECE 4730
Name: Rodrigo Ignacio Rojas Garcia

Parallel Matrix Vector Multiply

In this laboratory we were required to write four programs regarding matrix multiplication with the purpose of teaching the student about the speedup with parallel programming when compared with sequential programming.

The first program required the student to create a program which created a square matrix or vector of size **n** and of user desired range in which the numbers in matrix/vector were of type **double** and output the matrix/vector as a binary file.

The second program consisted on developing a program which would print the binary file created from the first program and printed it in ASCII.

The third program was to develop a program which took 2 inputs, a matrix and a vector, with the purpose of outputting a binary file which contained the result of the matrix multiplication.

The fourth program was to create a parallel program which took two input files, a matrix and a vector with the purpose of outputting a binary file which contained the result of the matrix multiplication. To create this parallel program, the student used the MPI library and topology which was required to divide the arithmetic and manage communication between tasks.

As a result, the student was to time the matrix multiplication of both sequential and parallel matrix multiplication programs. The parallel program was also tested with different matrix sizes and different number of tasks to show the speedup between the parallel and sequential programs. The result be seen below:

RESULTS

Tests:

Problem Size [n]	Serial [s]	Parallel [s]	Processors	Speedup
256	0.000232	0.000123978	4	1.871304862
512	0.000805	0.000513077	4	1.568965948
1024	0.003164	0.002117157	4	1.494456966
2048	0.013585	0.008498192	4	1.598575352
4096	0.051862	0.033390045	4	1.553217426
256	0.000232	8.2016E-05	8	2.828716651
512	0.000805	0.000390053	8	2.063823178
1024	0.003164	0.001311064	8	2.413307484
2048	0.013585	0.005627871	8	2.413879256
4096	0.051862	0.020982981	8	2.471622153
324	0.000321	9.08375E-05	9	3.533783685
729	0.001615	0.000528097	9	3.058149418
1296	0.005075	0.00158	9	3.212025472
2025	0.012416	0.004195929	9	2.95905895
2916	0.012348	0.008229971	9	1.500369819
256	0.000232	3.91006E-05	16	5.933405659
512	0.000805	0.000128984	16	6.241062329
1024	0.003164	0.000499964	16	6.328458682
2048	0.013585	0.002460003	16	5.522351215
4096	0.051862	0.009166956	16	5.657494188
400	0.000489	5.10216E-05	25	9.584180636
625	0.001194	0.000127077	25	9.395870499
900	0.002461	0.000283957	25	8.6668196
1225	0.004548	0.000544786	25	8.348225204
1600	0.007688	0.000957012	25	8.033335613

Speed Up Graph: