

PROJECT ASSIGNMENT - 2

PTHREADS REPORT

MULTIPROCESSOR SYSTEM (DV2544)

PARALLEL IMPLEMENTATION OF GAUSSIAN ELIMINATION

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Parallel Version of Gaussian Elimination:

Task: To write a parallel implementation of Gaussian elimination using Pthreads.

Gaussian Elimination: In order to solve a system of linear equations in linear algebra, we use a technique called **row reduction** which is also known as Gaussian Elimination. We get the solution to the linear equations by performing a series of operations on a matrix, which is obtained from the coefficients of the given linear equations.

Data Structures: A 2-dimensional double array, matrix [MAX_SIZE][MAX_SIZE], is allocated in the global scope. Following to the initial matrix, vector b and vector y are also allocated as double arrays in the global scope.

Work Allocation: As the Gaussian elimination is all about row reduction, we have allocated each thread with a row and sometimes a thread may get multiple rows. Here we have divided the operations into two groups, division group and elimination group. The threads perform the operations of the elimination group only when all the threads are completed with the operations of the division group and vice versa. In

this method, the threads will be executed in a synchronized manner.

Measurements:

Matrix Size	Sequential Version			Parallel Version (1 CPU)			Parallel Version (8 CPUs)			Speedup on 8 cpus
	Execution Time (sec)		CPU Utilized	Execution Time (sec)		CPU Utilized	Execution Time (sec)		CPU Utilized	
	<i>System</i> <i>m</i>	<i>Elapsed</i> <i>d</i>		<i>System</i> <i>m</i>	<i>Elapsed</i> <i>d</i>		<i>System</i> <i>m</i>	<i>Elapsed</i> <i>d</i>		
32	0.00	0.00	0%	0.00	0.00	0%	0.00	0.00	100%	-
64	0.00	0.00	0%	0.00	0.00	0%	0.00	0.00	133%	-
128	0.00	0.00	57%	0.00	0.00	57%	0.02	0.01	155%	-
256	0.00	0.04	93%	0.00	0.05	96%	0.05	0.04	227%	1
512	0.00	0.38	100%	0.00	0.38	99%	0.06	0.14	367%	2.7
1024	0.01	3.02	99%	0.01	3.05	99%	0.14	0.56	608%	5.3
2048	0.04	24.1	99%	0.06	24.29	99%	0.34	4.30	728%	5.6

Conclusion: From the above speedup values it is clearly evident that the parallel version executes faster than the sequential version. Whereas the CPU utilization is heavy in parallel version than in the sequential version.

References

- [1] A. Grama, A. Gupta, G. Karypis, and V. Kumar, *Introduction to parallel computing, 2nd edition*, Addison-Wesley, 2003.