

# PROJECT ASSIGNMENT 1

## MPI : MESSAGE PASSING INTERFACE

### IMPLEMENTATION DETAILS

#### 1) Matrix – Matrix Multiplication:

Aim :- To implement a checkerboard version of parallel matrix-matrix multiplication.

Assumptions :- Input matrices are square matrices of order  $n$ , where  $n$  is an even number greater than the number of available nodes.

Implementation Details :-

- 1 Node: The sequential algorithm is used for the 1 node implementation of matrix multiplication.
- 2 Node: If a matrix A has  $n$  rows, each node receives  $n/2$  rows of A and the entire matrix B. At each node the matrix multiplication is performed and the results are sent back to the master node.
- 4 Nodes : In case of 4 nodes matrix A is divided into 2 parts with equal number of rows, A1 and A2 and matrix B column wise into B1 and B2. Master node computes A1B1. Slave nodes 2,3,4 compute A1B2, A2B1, A2B2 respectively.

A1
A2

Matrix A

B1	B2
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Matrix B

- 8 Nodes : In case of 8 nodes matrix B is divided into 4 parts with equal number of rows using A1,A2,A3,A4 and matrix B column wise into B1,B2. Master node computes A1B1 and the slave nodes 2,3,4,5,6,7,8 compute A2B1,A3B1,A4B1,A1B2,A2B2,A3B2,A4B2.

A1
A2
A3
A4

Matrix A

B1	B2
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Matrix B

## 2) Laplace approximation

Aim :- To implement the parallel version of the laplace approximation algorithm

Algorithm :- Jacobi Algorithm i.e Use two matrixes, one for old values and one for new values. Swap role after each iteration.

Implementation :

Initially the user must give a text file as an input to the program. The text file should consist of the values of a matrix where each value is separated by a tab space and each row is separated by a line space. The acceptance value should be entered in the command line after the start of execution

- 1 Node : For the one node implementation the whole matrix will be computed in a serial order.
- 2,4,8 Nodes : If the size of the matrix is n then for implementing a parallel algorithm on k number of nodes ,each node would compute n/k rows in parallel.

Ex : If the laplace approximation for Matrix of size 1024 is to be performed on 4 nodes, then each node would compute 256 rows in parallel.