

Title: Parallel Matrix Multiplication using MSMPI for Large Matrices

Objective:

The objective of this assignment is to implement parallel matrix multiplication using the Microsoft MPI (MSMPI) library for large matrices loaded from external binary files. The assignment aims to demonstrate understanding and proficiency in parallel computing techniques, particularly in the context of matrix operations.

Tasks:

- Implement a parallel matrix multiplication algorithm using MSMPI.
- Load input matrices from external binary files(as parameters).
- Optimize the implementation for efficient computation of large matrices (5000x5000).
- Measure the execution time of the parallel implementation using appropriate timing mechanisms.
- Evaluate the performance of the parallel implementation in terms of **speedup** and **efficiency**.
- Document the implementation process, including code explanations, optimization strategies, timing mechanisms, and performance analysis.

Deliverables:

Source code implementing the parallel matrix multiplication algorithm using MSMPI. Input matrices stored in binary files (A.bin and B.bin). Documentation explaining the implementation approach, optimization techniques, timing mechanisms used, and performance evaluation. Performance analysis report detailing the observed **speedup**, **efficiency** metrics, and **timing** results.

Guidelines:

- Use C/C++ programming language for implementation on your local machine first.
- Ensure proper error handling and validation of input matrices.
- Document code extensively with comments explaining the logic and MPI-specific functions.
- Implement optimization techniques such as loop restructuring, data decomposition, and communication minimization.
- Use appropriate timing mechanisms (e.g., MPI_Wtime) to measure execution time.
- Conduct experiments with different numbers of MPI processes to evaluate **scalability**.
- Present results in a clear and organized manner, including tables and charts where necessary.
- Submit both source code files and documentation in a compressed folder.

Evaluation Criteria:

- Correctness of parallel matrix multiplication implementation.
- Efficiency and scalability of the parallel solution for large matrices.
- Accuracy and appropriateness of timing mechanisms used.
- Clarity and completeness of documentation, including explanations of optimization techniques, Data visualizations (Figures) for the results.
- Accuracy of performance analysis and interpretation of results.

Submission:

Submit the assignment by [May 13 23:59] via the MS Teams platform. Late submissions may incur penalties as per the course policy.

Note: Refer to course materials, textbooks, and online resources for relevant information on MPI programming, parallel computing, matrix operations, and binary file handling.