Spring / 2022

Term project

Write a massage passing based parallel program to solve the assigned problem to you, which includes a PDE and solution method, and following the steps described below show the scalability of your algorithm.

Project Guidelines

The following steps **must be included** in your term project:

1) The parallel algorithm of the assigned problem must be written in C, C++ or Fortran, together with one of the following parallel programming tools:

    i) MPI,

    ii) OpenMP

    iii) Mixed (MPI-OpenMP),

While constructing your algorithm, the following structures must be considered and implemented in your algorithm (50 points):

    i) Virtual (or Graph) topology,

    ii) MPI Derived Data Type(s)

During the solution of the set of linear equations, either multi-coloring or red-black algorithms must be used.

At the 12th Week *Interval Project Approval:*

1) Submit your initial parallel program and explain the solution procedure you implemented (including virtual topology and derived data type) ,

2) Projects that did not pass the interval approval process are going to be reduced %50 percentage.

2) Explain the tuning process of your parallel algorithm by using necessary tools (such as TAU, Vampire, Trace Analyzer etc.) and show the potential

improvement on the algorithm (10 points)

3) Discuss the results you obtain considering the time consumption for the following items and display the results on plots. Use (1, 2, 4, 8, 16, 32, 64, 128, 256) number of cores to run your parallel algorithm. (40 points)

   i) Introduce and describe your problem and its details. (10 points)

   ii) Plot a graph for Wall clock time versus number of procs. (6 points)

   iii) Plot a graph for Speedup versus number of procs. (6 points)

   iv) Plot a graph for Efficiency versus number of procs. (6 points)

   v) Plot a graph for Problem size (it is up to you to increase or reduce the problem size) versus time. (6 points)

   vi) Discuss the possible limitations preventing the possible scale-up. (6 points)

Submission process

Each student **must provide** the following items:

i. Comprehensive project report including all the details of your study (Mathematical model you used and the solution steps you achieved)

ii. Submit the hard copy and soft copy (in CD) of your project incl. software.

iii. Students will be presenting their projects at the end of the term (To Be Arranged in the class) and maximum time allowed for each presentation will be 10 minutes. PLEASE DO NOT SUBMIT your presentation material as a project report.

Due Date: June 3, 2022