Distributed Systems

Assignment 6

In this Assignment, you will write parallel codes using mpi programming for solving Linear Systems. You can refer to Chapter 12 of the book (Parallel Programming in C with MPI and OpenMP by Micheal J. quinn, 2003) for more details on the topic and algorithms. (100 marks)

Language Constraint: **C/C++**

Include a bash script to run each of the code in your submission. Name them q1.sh, q2.sh

Marks for each question are for code + explanation.

Q 1) (40 marks)

Implement a parallel program to solve a system of linear equations Ax = b using the **Gaussian Elimination row-oriented algorithm** followed by back substitution. Your program should input the system of equations from a file. The file contains a matrix of doubles, the first two elements of the file are two integers. The first has the value n, the second has the value n + 1. The remainder of the file contains n(n + 1) doubles, corresponding to the elements of A and b stored in this order:

$$a_{0,0}, a_{0,1}, \ldots, a_{0,n-1}, b_0,$$
$$a_{1,0}, a_{1,1}, \ldots, a_{1,n-1}, b_1, \ldots,$$
$$a_{n-1,0}, a_{n-1,1}, \ldots, a_{n-1,n-1}, b_{n-1}$$

Q 2) (40 marks)

Implement a parallel program to solve a system of linear equations Ax = b using the **Conjugate Gradient Method**. You can be assured that A is a symmetric, positive definite matrix.
Your program should input the system of equations from a file. The file contains a matrix of doubles. The first two elements of the file are two integers. The first has the value n,the second has the value n +1. The remainder of the file contains n(n + 1) doubles, corresponding to the elements of A and b stored in this order

$$a_{0,0}, a_{0,1}, \ldots, a_{0,n-1}, b_0,$$
$$a_{1,0}, a_{1,1}, \ldots, a_{1,n-1}, b_1, \ldots,$$
$$a_{n-1,0}, a_{n-1,1}, \ldots, a_{n-1,n-1}, b_{n-1}$$

Q 3) Prepare a Readme showing Comparison of the performance of these two algorithms and show the results. You have to generate input for performance comparison. (Take matrix A of considerable size, say 1000X1000)	(20 marks)

Note: Strict actions would be taken against anyone found involved in any kind of plagiarism either from the internet or from other students.