University of Colorado
Department of Computer Science

Numerical Computation CSCI 3656

Spring 2016

Problem Set 5

Issued: 16 February 2016

Due: 23 February 2016

1. *[7 pts]* Use the Jacobi method to solve this system starting from a guess of $[x_1, x_2, x_3]^T = [0, 0, 0]^T$. Perform at least four iterations.

$$\begin{aligned} 6x_1 - 2x_2 + x_3 &= 11 \\ -2x_1 + 7x_2 + 2x_3 &= 5 \\ x_1 + 2x_2 - 5x_3 &= -1 \end{aligned}$$

2. *[10 pts]* Use the Gauss-Seidel method to solve that same system from the same guess. Perform at least four iterations. Does this appear to converge more quickly than Jacobi? *Should* it?

3. Gaussian elimination vs. Gauss-Jordan:

   (a) *[4 pts]* What is the difference between these methods, in terms of the way they work (i.e., the algorithm)?

   (b) *[3 pts]* Which one runs faster, for really large matrices? (Hint: check out section 2.1.2 of Sauer and think about how to modify that analysis for Gauss-Jordan.)

   (c) *[5 pts]* How would you parallelize Gaussian elimination—i.e., what would you have each processing unit doing?

   (d) *[5 pts]* How would you parallelize Gauss-Jordan—i.e., what would you have each processing unit doing?

4. *[6 pts]* Problem 4(b) on page 93 of the textbook.

5. *[20 pts]* Computer problem 4 on page 136 of the textbook. Please turn in a table of the iterates (like the ones on page 133) and a copy of your code.