

Numerical Analysis Semester 081 Problem Set 6

Reference: Chapter 04.08 Gauss-Seidel Iterative Method

For these problems show all work by hand

1. a) Compute the exact solution to the following system (you can use your calculator, MATLAB, or do by hand).

$$\begin{aligned}4x_1 + x_2 &= 7 \\ -x_1 + 5x_2 &= -7\end{aligned}$$

b) Determine whether the matrix of coefficients for the above system is diagonally dominant. (Justify)

c) Start with initial point $\mathbf{x} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, perform the first 3 iterations of Gauss-Seidel to approximate a solution to the above system.

d) Is the iteration converging to the solution?

2. Repeat the above parts for the system except use a starting value of $\mathbf{x} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$

$$\begin{aligned}10x_1 + x_2 - x_3 &= 18 \\ x_1 + 15x_2 + x_3 &= -12 \\ -x_1 + x_2 + 20x_3 &= 17\end{aligned}$$

3. Repeat the above parts for the system

$$\begin{aligned}-x + 3y &= 1 \\ 6x - 2y &= 2\end{aligned}$$

4. Repeat the above parts for the equivalent system that results when you swap the two rows in problem 3.