

NMA – homework from week 2

1. Fixed point iteration: Consider a linear system $x = Ux + v$, where

$$U = \begin{bmatrix} 0 & -0.49 \\ 1 & 0 \end{bmatrix} \quad v = \begin{bmatrix} 5 \\ 10 \end{bmatrix}.$$

- Will Fixed point iterations converge for this system? Give reasons.
- Use $x^{(0)} = v$ and compute $x^{(1)}$ and $x^{(2)}$ by Fixed point iterations.
- Compute the row norm of the difference of the vectors $x^{(1)}$ and $x^{(2)}$.

2. Jacobi method: Consider a linear system $Ax = b$, where

$$A = \begin{bmatrix} 1 & -10 & -2 \\ -1 & 5 & 0 \\ 2 & 0 & 2 \end{bmatrix} \quad b = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}.$$

- Will Jacobi method converge for the given system? Give reasons for your answer.
- Choose $x^{(0)} = b$ and compute $x^{(1)}$ and $x^{(2)}$ by this method.

3. Gauss-Seidel method: Consider a linear system $Fx = g$, where

$$F = \begin{bmatrix} 6 & 3 & -3 \\ 3 & 2 & 0 \\ -3 & 0 & 9 \end{bmatrix} \quad g = \begin{bmatrix} 8 \\ -4 \\ 3 \end{bmatrix}$$

- Will Gauss-Seidel method converge for the given system? Give reasons for your answer.
- Choose $x^{(0)} = [0, 0, 0]^T$ and compute $x^{(1)}$ and $x^{(2)}$ by this method.