Homework #4

- Textbook: 2.1.13, 2.1.23, 2.1.31, 2.1.32, 2.1.17, 2.1.27, 2.1.30.

- Programming:

  1. Write a function in Matlab that takes as input the number \( n \), an \( n \times n \) matrix \( A \), an \( n \)-component column vector \( b \), an \( n \)-component column vector \( x_0 \), and the number of steps \( N \). Have it output the approximate solution of Jacobi method solving \( Ax = b \) using \( x_0 \) as initial guess, iterated for \( N \) steps. Also have it output the number of flops used.
     
     (a) Write out or print out your function.
     
     (b) Choose a 10×10 example where the method does not look like it is converging after 100 steps. Write down your results and the number of flops used.

  2. Write a function in Matlab that takes as input the number \( n \), a sparse matrix given as \( r, c, v, m \) (as in HW #2), an \( n \)-component column vector \( b \), and a tolerance \( tol \). Directly use this coordinate list form to output the approximate solution of Jacobi method solving \( Ax = b \) using the zero vector for initial guess and iterated until the 2-norm (do not use Matlab’s ‘norm’ command) of the residual falls below \( tol \) (while loop); the number of iterations used; the number of flops used for calculating the approximation; and the 2-norm of the final residual vector.
     
     (a) Write out or print out your function.
     
     (b) Create the \( r, c, v, m \) for the 10×10 tridiagonal matrix with 2’s down the main diagonal and −1’s in the upper and lower diagonals. Take \( b \) the vector of 1’s and \( tol = 10^{-4} \) and write down your results for the number of iterations, the 2-norm of the residual vector, and the number of flops used. What about for \( tol = 10^{-8} \)?