Math 128B, Spring 2021.

Homework 5, due February 27.

Prob 1. Create a MATLAB function that inputs a matrix A, a vector $x^{(0)}$, a tolerance bound tol and uses the power method with the stopping criterion $\|x^{(k)} - x^{(k-1)}\|_\infty < tol$ to obtain an approximate eigenpair (λ, x). Run your algorithm with

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix}, \qquad x^{(0)} = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}, \qquad tol = 0.01.$$

Prob 2. Let

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

Use the Power Method, Wielandt deflation, and the Inverse Power method to approximate the eigenvalues and eigenvectors of A.

Prob 3. Use Householder's method to place the following matrix in tridiagonal form:

$$A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}.$$

Prob 4. Modify Householder's algorithm to find a Hessenberg matrix similar to the matrix

$$A = \begin{bmatrix} 4 & 1 & 1 & 1 \\ 1 & 4 & 0 & 0 \\ 1 & 1 & 4 & 0 \\ 1 & 1 & 1 & 4 \end{bmatrix}.$$