

APPM/MATH 4660 Homework #4

DUE 03/21/08

March 15, 2008

Feel free to work in groups, but your final code and your final writeup must be your own work. Please also hand in a copy of both your code as well as the output.

1. Consider the following matrix

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

with eigenvalues $\{1.2679, 4.7321, 5, 5\}$

- Write code to perform a Householder transformation. Apply it to A , converting it to upper Hessenberg form.
- Write code that takes an upper Hessenberg matrix and computes its QR decomposition using rotations. Apply it to the matrix created in 1a.
- Write code that takes the upper Hessenberg matrix created in 1b and performs 100 iterations of the QR algorithm to approximately identify the eigenvalues.

2. Consider the following matrix

$$B = \begin{bmatrix} -2 & 1 & 0 & 0 & 0 & 0 \\ 1 & -2 & 1 & 0 & 0 & 0 \\ 0 & 1 & -2 & 1 & 0 & 0 \\ 0 & 0 & 1 & -2 & 1 & 0 \\ 0 & 0 & 0 & 1 & -2 & 1 \\ 0 & 0 & 0 & 0 & 1 & -2 \end{bmatrix}$$

with eigenvalues $\{-3.8019, -3.247, -2.445, -1.555, -0.75302, -0.19806\}$. Perform 100 iterations of the QR algorithm to approximately identify the eigenvalues.

3. Section 11.1, problem #3b,c. Be sure to include a plot of your solution.