

Math128B  
Feb. 19, 2005  
Jonathan Dorfman  
Homework 5 Solutions

file	function
Hmwk5Main.m	cooks up random matrix <b>A</b> , symmetrizes it to <b>B</b> , and also predefined 3x3 symmetric <b>C</b> calls Householder on <b>B</b> to reduce to symmetric tridiagonal calls Householder on <b>A</b> to reduce to Upper Hessenberg call QRShift on <b>C</b> to reduce to diagonal ( $tol = 10^{-5}$ )
Householder.m	implements Householder Method according to p.630 of Mathews & Fink (Program 11.4 with slight modification using recursion)
QRShift.m	implements QR algorithm with Shifts according to p.636 of Mathews & Fink (Program 11.5 with slight modification using recursion)

A diary of the output follows:

---

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
Hmwk5Main
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
Householder: Symmetric to (similar) Tridiagonal
random 5x5 symmetric matrix is:

B =
    1.8850    1.2741    0.9089    1.3232    0.9983
    1.2741    1.2582    0.9233    1.2368    1.1131
    0.9089    0.9233    0.4376    0.3865    0.6835
    1.3232    1.2368    0.3865    0.4496    1.5624
    0.9983    1.1131    0.6835    1.5624    0.6269

reduction to (symmetric) tridiagonal form is:

X =
    1.8850   -2.2797    0.0000         0    0.0000
   -2.2797    3.7048   -0.6686    0.0000   -0.0000
    0.0000   -0.6686   -0.9055   -0.3082   -0.0000
         0    0.0000   -0.3082    0.0317   -0.2156
    0.0000   -0.0000   -0.0000   -0.2156   -0.0589

comparison with Matlabs Hess(B):

ans =
    0.2227    0.1349         0         0         0
    0.1349   -0.0479   -0.3699         0         0
         0   -0.3699    0.0702    1.4659         0
         0         0    1.4659    3.7853   -2.2680
         0         0         0   -2.2680    0.6269

```

Householder: Arbitrary to (similar) Upper Hessenberg  
 random 5x5 matrix is:

A =

0.9425	0.5039	0.1715	0.4570	0.0073
0.7701	0.6291	0.1307	0.7881	0.5887
0.7374	0.7926	0.2188	0.2811	0.5421
0.8663	0.4486	0.1055	0.2248	0.6535
0.9909	0.5244	0.1414	0.9089	0.3134

reduction to Upper Hessenberg form is:

X =

0.9425	-0.5417	-0.1415	0.0894	-0.4132
-1.6939	1.8315	-0.0111	0.3537	0.5306
0	0.3629	0.0611	-0.1052	0.1303
0.0000	-0.0000	0.3602	-0.1529	-0.3360
-0.0000	0.0000	0.0000	-0.1518	-0.3536

comparison with Matlabs Hess(A):

ans =

0.9425	-0.5417	-0.1730	0.0245	-0.4101
-1.6939	1.8315	-0.0111	-0.5080	0.3855
0	0.3629	0.0611	-0.1052	0.1303
0	0	0.3602	-0.1529	-0.3360
0	0	0	-0.1518	-0.3536

QR (with shifts): Symmetric to (similar) Diagonal  
 specified symmetric 3x3 matrix is:

C =

2	-1	0
-1	-1	-2
0	-2	3

eigenvalues resulting from reduction to diagonal form using tol=.00001 is:

-2.041	2.1295	3.9115
--------	--------	--------

comparison with Matlabs eig(A):

-2.041	2.1295	3.9115
--------	--------	--------