Math 128b – Spring 2014 – Homework set 8

Due Tuesday 4/1 in class before the lecture starts.

1. Code

   (a) simultaneous iteration,

   (b) the "pure QR" method,

   to find all eigenvalues of an $n \times n$ matrix. Test your codes on the matrix

   $$A = \begin{pmatrix} 7 & -33 & -15 \\ 2 & 26 & 7 \\ -4 & -50 & -13 \end{pmatrix},$$

   and compare with Matlab's command "eig(A)" gives you.

   You should hand in (i) your code for both methods; (ii) the results of both methods applied to A.

2. What happens when you apply "pure QR" to an orthogonal $n \times n$ matrix Q (recall that Q is orthogonal if $Q^T Q = I$).

3. Give an example to show that the operation "subtract a multiple from one row from another" can change the eigenvalues of a given real square matrix A.

4. Let A be an $n \times m$ matrix and let B be an $m \times n$ matrix. Show that the nonzero eigenvalues of AB are the non-zero eigenvalues of BA.

5. Type "randn(1e5)" into Matlab. Find out what this command does. Describe what happens to your computer (if "nothing" happens, try randn(1e6)). Why does this happen? What does this tell you about the size/type of matrices we can deal with using the techniques we developed for solving linear systems of equations, solving least squares problems and solving eigenvalue problems?