MATH 612: CM4ES&FM

Spring'14 | Homework # 2 | Due March 14

Instructions

- One problem per page. (You can have two problems in different sides of the same page.)
- Programming problems should be turned in by two-people teams. If you work your coding problems with your programming buddy, you will be considered a team, and then have to turn in these computational problems as such.

> Not all assigned problems will be graded. You'll know which ones will at the time everyone has turned them in. You will not be off the hook for any particular chapter, since assignments might revisit past chapters.

1. Problem 2.7
2. Problem 5.3
3. Problem 6.2
4. Problem 6.4(b)
5. Problem 7.2
6. Problem 7.5
7. Problem 10.1
8. **The QR method.** For this assignment you need to use a full QR factorization method. You can use your own Householder code, the one in the website, or Matlab's own `qr`. We start with a matrix A and do as follows: we start with $A_0 = A$, and the for $j \geq 0$

$$\text{decompose } A_j = Q_j R_j, \qquad \text{and then build } A_{j+1} = R_j Q_j.$$

Note that

$$A_{j+1} = Q_j^* Q_j R_j Q_j = Q_j^* A_j Q_j = \ldots = (Q_0 \ldots Q_j)^* A_0 (Q_0 \ldots Q_j),$$

so all the matrices in the sequence A_j are similar. In many cases the sequence A_j converges to an upper triangular matrix (thus revealing the eigenvalues of A). If A is Hermitian, all matrices A_j are Hermitian and therefore, in case of convergence, the method converges to a diagonal matrix. *Given as here, this is not a great method. There are ways to improve it.* Code this method and test it with several matrices. It is a requirement for convergence that all eigenvalues are real. (Can you see why?)