MATH 612: CM4ES&FM

Spring'14 | Coding assignment # 3 | Due April 21

1. Code Gaussian elimination with complete pivoting. Complete pivoting means that when you have to choose a pivot in the j-th step of elimination (zeros in the j-th column), you choose the one with the largest absolute value in the block a_{ik} for $k \leq i, k \leq m$. The method then swaps rows and columns. Here are the rules for the code:

   - The method should never physically swap rows or columns. This has to be done with pointers to the rows and columns.
   - Multipliers have to be stored in lieu of the zeros.
   - The code should modify the right-hand-side so that at the end we could solve an upper triangular system.

   If you do things properly, at the end of the process you should have a factorization

   $$P_1 A P_2 = LU$$

   where P_1 and P_2 are permutation matrices. Check that it works. Also, check that you can actually solve the resulting upper triangular system, which might be stored in an unusual place.

2. Code the symmetric Gauss-Seidel method in a function

   ```
   [x,it]=symmetric_gauss_seidel(A,b,x0,itMax,tol)
   ```

   where we want to solve $Ax = b$, starting iterations at x_0, stopping when $\|x_{n+1} - x_n\| \leq \text{tol} \times \|x_{n+1}\|$ or after itMax iteration. In the output return the final x_n and the number of iterations it got you to find it. It might take you some time to find a system where this method converges.