Math 4353/5393 – Numerical Linear Algebra — Spring 2020
Program 2 — Due Friday, February 21, 2020

1. Write an m-file, genp.m, which computes the LU factorization of $A \in \mathbf{R}^{n\times n}$. The routine should take as input a square array A and give as output the triangular factors L and U stored in the array A (the diagonal elements of L are 1's, and so do not need to be stored). The first line should be:
   function A = genp(A)

2. Write a subroutine backsub (in file backsub.m) to solve an upper triangular system. The first line should be:
   function [x] = backsub(U,y)

3. Write a subroutine forsub (in file forsub.m) to solve a lower triangular system. The first line should be:
   function [y] = forsub(L,b)

4. I will email you a test program NLAProg2Test.m. After all of your programs are working correctly, run NLAProg2Test and send me the diary file ('prog2run.txt') that it creates, as well as genp.m, backsub.m and forsub.m.

   Notes:

   (a) This method (G.E. without pivoting) is *not* a good general purpose method, although it is a good method for some important cases.

   (b) Feel free to play with your code. Try different values of n, or different matrices (the Hilbert matrix in my test routine is especially difficult (illconditioned), but you can generate a matrix which has entries taken from a uniform distribution on $[-1, 1]$ using A=2*rand(n)-1; random matrices tend to be rather well conditioned).

   (c) Remember to document your code. This means using comment lines to carefully describe all input and output variables *the help-block*, and in your code to describe what you are doing if it is not obvious.

   (d) Remember to avoid the most common overflow by checking for "small" (or 0) divisors *before* you divide.