

## Homework #4 Due: Friday March 1

Math 471

Problem 1 should be written up and given to me. Problem 2 must be demonstrated in class on Friday March 1. I would like a paper copy of program you wrote for Problem 2.

### 1. Counting Computational Complexity in Gaussian Elimination.

For a general  $n \times n$  matrix, show that the steps of Gaussian elimination of the augmented matrix take at most  $n(n-1)(2n-1)/6$  multiplications/divisions and also that the back substitution part takes  $n(n+1)/2$  multiplications/divisions. You may find the following useful.

$$\sum_{k=1}^n 1 = n \quad \sum_{k=1}^n k = \frac{n(n+1)}{2} \quad \sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$$

**Grad Students** Count the number of additions/subtractions for each of these routines.

### 2. Solving $Ax = b$ given $A = LU$ .

Write a matlab function with the first line

**function x = mysol(L,U,b)**

which takes as input: an  $n \times n$  lower triangular matrix  $L$  with ones on the diagonal, an  $n \times n$  upper triangular matrix  $U$ , and an  $n$ -vector  $b$ , and returns  $x$  such that  $LUx = b$  by first solving  $Ly = b$  for  $y$  using forward substitution and then solving  $Ux = y$  for  $x$  using backward substitution. You can test your program using MATLAB'S built in system solver: The Forward Slash, usage:  $x = (L*U)\backslash b$  yields the solution to  $LUx = b$ , if one exists.