MATH 5370: FINAL PROJECTS ANNOUNCEMENTS

PROJECT ONE:

1. Device an efficient algorithm to invert an n x n lower triangular matrix A.
2. Code your algorithm and test it on
   (a) matrix A with entries $a_{ij} = (i+j)^2$, $i \geqq j$.
   (b) matrix A with entries $a_{i,i-1}=1$, $a_{i,i}=1.5$.
3. Start with n = 2, 3, … 10. Report how far you can reach with such computations?
4. Form the product $A*A^{-1}$ to test the computed inverse.

PROJECT TWO:

1. Implement a code to realize the Gauss elimination algorithm to solve Ax=b where A is a nxn matrix. Provide the factorization of A=LU where L and U are lower and upper triangular matrices.
   (a) You can start with A:

   1 6 0
   2 1 0
   0 2 1

   and $b = [3\ 1\ 1]^T$.
   (b) For the second matrix A:

   -1 1 0 - 3
   1 0 3 1
   0 1 -1 -1
   3 0 1 2

   and the corresponding $b = [4\ 0\ 3\ 1]^T$.
   (**c**) A and b are described:

   $a_{i,j} = 0.1$ if $1 \leqq i \leqq n-1$, $j=i$. $b_i = 2.1-i$ $i,1,2,...,n$.
   $a_{i,j} = 1$ if $1 \leqq i \leqq n$, $j=n$. $b_n = 2-n$
   $a_{i,j} = -1$ if $i > j$
   $a_{i,j} = 0$ otherwise.

   Compare the Gauss elimination algorithm to: Gauss Elimination and directly solving the above system.

PROJECT THREE:

For a given n x n matrix,

1. Please compute the condition number k(A) of the matrix $k(A) = ||A||*||A^{-1}||$ for the matrices described in projects One and Two.
2. Consider the matrix H with entries $H_{ij} = (i+j-1)^{-1}$, $i,j=1,2,...,n$.

I. Calculate the condition number of this matrix and the determinant of this matrix for values of n=2,3,...10. How far can you get to compute this quantity?

II. Can you determine the dependence of the condition number on n ?

PROJECT FOUR:

Steepest descent v.s. conjugate gradient method for the two matrices described in Project Three.Take $b=[1,1,...1]^T$.

PROJECT FIVE:

Generate probability distributions and calculate entities associated with them verify basic properties of distributions. Project Proposal presentation is needed! (Presentation date 28th October)

PROJECT SIX:

Financial Models using optimization. (Here is the Matlab analogue) Project Proposal presentation is needed! (Presentation date 28th October)

PROJECT SEVEN:

Genetic Algorithm. Project Proposal presentation is needed! (Presentation date 28th October)