CS 383C
CAM 383C/M 383E Numerical Analysis: Linear Algebra Fall 2008

Homework 6

Instructor: Inderjit Dhillon Date Due: Oct 29, 2008

Keywords: *Gaussian Elimination, Partial Pivoting, Complete Pivoting*

1. Problem 21.5, 21.6

2. Consider matrices $W_n(x)$ of the form:

$$W_5(x) = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ -1 & 1 & 0 & 0 & 1 \\ -1 & -1 & 1 & 0 & 1 \\ -1 & -1 & -1 & 1 & 1 \\ -1 & -1 & -1 & -1 & 1+x \end{pmatrix}, \quad 0 \leq x \leq 2.$$

   a What is the condition number (use "rcond" in MATLAB) of $W_n(x)$ when $n = 25, 50, 100$ and $x = 0, 1, 2$?

   b What is the LU decomposition of $W_n(x)$? Does partial pivoting make any difference?

   c Consider single precision arithmetic in which $fl(2^{24} + 1) = 2^{24}$. Find the smallest value of n for which Gaussian Elimination will return the solution of $W_n(0)y = e_1$, when we asked for $W_n(1)y = e_1$? What about in IEEE double precision arithmetic?

   d Can you tell based on the above if the MATLAB command "\" does partial or complete pivoting?

   Answers to b and c should use pen and paper only (but feel free to experiment in MATLAB).

3. Implement Gaussian Elimination with Partial Pivoting (GEPP) and with Complete Pivoting(GECP). Verify on the matrix given in the previous problem that GECP gives higher accuracy solution than GEPP.