CS 323E **Homework 10** **Due: April 22 2003**

1. The MATLAB command `hilb(n)` generates an $n \times n$ Hilbert matrix, which we denote by H_n. Try $n = 3, 10, 20$ in the following problems:

   1) (4 points)
   Solve:
   $$H_n x_n = b_n$$
   for x_n, where $b_n = H_n * \texttt{ones}(\texttt{n}, 1)$.
   Use the MATLAB command "\" to solve the above system. (See `help mldivide`).

   b) (2 points)
   How close is x_n to the exact solution? Comment.

   c) (4 points)
   Explain the accuracy of x_n. Use the command `cond` to get the condition number of H_n.

2. (5 points)
   Does the MATLAB command "\" do pivoting? Give an example to justify your answer.

3. (Use pen & paper). Let
   $$A = \begin{bmatrix} 10^{-16} & 10^{-17} \\ -10^{-16} & 10^{-17} \end{bmatrix}$$

   a) (2 points)
   Compute the determinant of A.

   b) (5 points)
   Compute $\kappa_1(A) = \|A\|_1 \cdot \|A^{-1}\|_1$.

   c) (2 points)
   Is A nearly singular? Comment.

   d) (1 point)
   Does the small magnitude of the determinant imply that A is nearly singular?

4. The MATLAB command `pascal(n)` generates an $n \times n$ Pascal matrix, which we denote by P_n. Try $n = 16$ in the following.

   a) (1 point)
   Using MATLAB, find the determinant of P_n.

   b) (1 point)
   Using MATLAB, find the condition number of P_n.

   c) (3 points)
   Is P_n close to singularity? Comment.