```
% Lecture 3/18/02:
%  (1) Tridiagonal LU and solution
%     [l,u] = TriDiLU(d,e,f);
%  Tridiagonal LU without pivoting. d,e,f are n-vectors
%     y = LBiDiSol(l,b);
% Solves the nXn unit lower bidiagonal system   L*x = b
%     x = UBiDiSol(u,f,y);
% Solves the nXn upper bidiagonal system   U*x = b
%     ---- The SMW formula (hw3_1)
%  (2) Gaussian elimination without pivoting
%      [L,U] = GE(A);
% The LU factorization without pivoting. If A is nXn
% then L is unit low triangr and U is up triang so A = L*U.
%      y = LTriSol(L,b);
% Solves the nonsingular lower triangular system Lx = b.
%      x = UTriSol(U,y);
% Solves the nonsingular upper triangular system Ux = b.
% where U is nXn, b is nX1, and x is nX1
% -----------------------
% Lecture 3/20/00
%  (1) Gauss elimination with pivoting
%    [L,U,piv] = GEpiv(A);      \
%    y = LTriSol(L,b(piv));     | same as x = A\b;
%    x = UTriSol(U,y);          /
%  (2) MATLAB routines
%    [L,U,P] = lu(A);   % can find piv as piv = P*(1:n)'
%    y = LTriSol(L,P*b);  % or y = L\P*b;
%    x = UTriSol(U,y);    % or x = U\y;
%     ---- Partitioned problems (hw3_2)
%     ---- Linear combinations/ auxiliary conditions (hw3_3)
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                         Homework 3
                    MA/CS 375, Spring 2002
                       Due March 25

-----------------------------------------------------------------------------
[i.] 6.2.4
[ii.] 6.3.4
[iii.] 6.3.6
[iv.] 6.3.7
[v.] 6.4.3
-------------------------------------------------------------DISCUSSION
% Problem 1 <6.2.4 >
%------------------
% Write a fuction
%      function x = TriCorner(d,e,f,alpha,beta,b)
%  that solves the "Tridiagonal matrix with corners"
%
%       T* x = b
% with
%      T = W + a*en*e1' + b e1*en'
%
% where W is tridiagonal, using the formula
%
%      x = z - Y * / 1+y_11    y_12 \^-1  /z_1\
%                  \  y_n1    1+y_n2/   * \z_n/
% where
%      z = W^-1 * b , Y = W^-1 [a*en b*e1]
%
%  Obviously, what is meant here, is not to compute W^-1 explicitly,
%  but rather "functionally". For example, z satisfies  W*z = b,
%  and is found easily once we obtain the LU factorization of W, and
% similarly for W^-1 * en and W^-1 * e1.
% ------------------------------------------------
%   Explanation of the formula
% ------------------------------------------------
% The underlying idea (see "Numerical Recipes"), is the identity
% (called the "Sherman-Morisson-Woodburry" (SMW) formula):
%
%  (A + U*V)^-1 =
%     A^-1 - [A^-1*U*(I+V'*A^-1*U)^-1*V'*A^-1]
%
% where A is nXn, U is nXk and V is kXn. When k is small compared
% to n, then this is an economical way for solving the problem, once
% an LU factorization for A is known. In the present problem, A is an
% nXn tridiagonal matrix, with cheap LU-factorization, so that a
% "rank-2" modification can also be done relatively easily.
% ------------------------------------------------
% Here, A = W, a tridiagonal matrix
% Also, a*en*e1'+b*e1*en' = /0 b\ * /1 0 ... 0 0\ ( =: V' (2Xn))
%                           |0 0|   \0 0 ... 0 1/
%                           |. .|
%                           |0 0| (=: U (nX2))
%                           \a 0/
% then, Y satisfies:
%     W*Y = U => Y = W^-1 * U
% while
%     V'*Y = /y_11  y_12\
%            \y_n1  y_n2/
% and, finally,
%     V'*W^-1*b = V'*z = /z_1\
%                        \z_n/
%
% ------------------------------------------------
% You are required to use the scripts:
%    TriDiLU.m
%    LBiDiSol.m
%    UBiDiSol.m
% ------------------------------------------------
% Note that the only real work here is the solution of the tridiagonal
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% system
%                    W * z = b
% ------------------------------------------------
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INSTRUCTIONS:
   The following format is required of all work turned in:
(0) Be as brief as you can, but give all information required to
    resolve a question.
(1) Team names must appear on top left hand corner ON ALL PAGES
    turned in.
(2) Staple your papers together.
(3) All work must be typed (say in Word or Latex); you may handwrite
    math symbols if you do not have access to appropropriate software.
(4) Your reports must be structured as follows:
Problem # (each beginning on new page):
(  i) Problem statement
( ii) Theoretical analysis of question: if an algorithm must be written
      to solve the problem, give the mathematical/theoretical outline
      here and describe the method of solution.
(iii) Results: a coherent presentation of results. Include a minimum of
      numerical/graphical info. that is needed to answer the question.
      One graph, properly labeled, is preferable to lists of numbers.
( iv) Discussion: what you did, how your work answered the question.
(  v) Printouts of scripts and results.
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