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56:271 Nonlinear Programming
Quiz #1

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Indicate whether true (+) or false (o). If false, briefly explain why, or give a counterexample.

___ 1. Cholesky factorization of a matrix A requires that A be symmetric.

___ 2. A pivot matrix is a product of elementary matrices.

___ 3. Given an LU factorization of the matrix A, the equation Ax=b (for any given vector b) may be solved by first backward substitution followed by forward substitution.

___ 4. If E_1, E_2, ... E_k are the elementary matrices corresponding to the k elementary row operations required for Gaussian elimination of matrix A, then the matrix product $(E_1 E_2 \ldots E_k)A$ is an echelon matrix.

___ 5. If E is an elementary matrix and A is a matrix of the same dimensions, then the product EA yields the same result as performing the corresponding elementary row operation on the matrix A.

___ 6. The inverse of an elementary matrix is also an elementary matrix.

___ 7. An echelon matrix must be square.

___ 8. Gauss-Jordan elimination is a more efficient method for solving Ax=b (for a specific b) than is Gauss elimination with backsubstitution.

___ 9. The inverse of a lower triangular elementary matrix is upper triangular.

___ 10. Given an LU factorization of the matrix A, the equation Ax=b (for any given vector b) may be solved by first solving Ly=b for vector y and then Ux=y for vector x.

___ 11. If E is an elementary matrix and A is a matrix of the same dimensions, then EA = AE.

12. Use forward & backward substitution (in the proper order) to solve the equation $LUx = b$, where

$$L = \begin{bmatrix} 1 & 0 & 0 \\ -2 & 2 & 0 \\ 1 & 0 & 1 \end{bmatrix}, U = \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 2 \end{bmatrix}, b = \begin{bmatrix} 3 \\ 6 \\ 5 \end{bmatrix}$$

X_1= ____ , X_2= ____, X_3= ____

___ 13. Which of the following is the result of a pivot in the upper left corner of the matrix

$$\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & -1 & 1 \end{bmatrix}?$$

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 1 & -1 \\ 0 & -3 & -3 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 5/2 & -1 \\ 0 & -3 & -3 \end{bmatrix}, C = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 1 & -1 \\ 0 & -5 & -1 \end{bmatrix}$$

(Note: All three can be obtained by row transformations, but only one is the result of a pivot!)