Department of Applied Physics and Applied Mathematics

Columbia University

APMA S3101D: Applied Math I - Introduction to Linear Algebra

Summer 2003

Problem Set 2

Note: This is for those who use the SECOND version of the textbook. Those who have the third version of the book please go to ps2-v3.ps

(Due June 12, 2003)

1. Problem Set 2.6: 1[1] , 7, 13

2. Problem Set 2.7: 7, 18

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[1](Important) Forward elimination changes $\begin{pmatrix} 1 & 1 \\ 1 & 2 \end{pmatrix} x = b$ to a triangular $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} x = c$:

$$\begin{matrix} x + y = 5 \\ x + 2y = 7 \end{matrix} \longrightarrow \begin{matrix} x + y = 5 \\ y = 2 \end{matrix} \qquad \begin{pmatrix} 1 & 1 & 5 \\ 1 & 2 & 7 \end{pmatrix} \longrightarrow \begin{pmatrix} 1 & 1 & 5 \\ 0 & 1 & 2 \end{pmatrix}$$

That step subtracted l_{21} =_____ times row 1 from row 2. The reverse step *adds* l_{21} times row 1 to row 2. The matrix for that reverse step is L =_____. Multiply this L times the triangular system $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} x = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ to get _____ = _____. In letters, L multiplies $Ux = c$ to give _____.

3. Problem Set 3.1: 7, 10[2] , 19

4. Problem Set 3.2: 3, 13, 15, 19[3]

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[2] (a) The plane of vectors (b_1, b_2, b_3) with $b_1 = b_2$.

(b)–(f) are same as problem 10.

[3] Prove that U and $A = LU$ have the same nullspace when L is invertible:

If Ux=0 then LUx=0. If LUx=0, how do you know Ux=0?