I. What $3 \times 3$ matrix $E$ multiplies $(x, y, z)$ to give $(x, y+z, 2y)$?

II. For each system of equations, write the corresponding augmented matrix and use elimination to solve it. In each step, keep note of the elimination matrices you used.

(a) $\begin{cases} -3x + 4y = -11 \\ 3x + 5y = 20 \end{cases}$

(b) $\begin{cases} 2x - 3y = 4 \\ x - 1.5y = 2 \end{cases}$

(c) $\begin{cases} u - v - w = 1 \\ 2u - v = 1 \\ v + 3w = 1 \end{cases}$

(d) $\begin{cases} -x - 2y + z = -4 \\ 2x + 4y + 3z = 3 \\ 3y + 2z = 1 \end{cases}$

Apply elimination to the $3 \times 4$ augmented matrix $[A\ \mathbf{b}]$. For what value of $c$ does the system have a solution?

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 4 & 7 & 12 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ c \end{bmatrix}$$

III. Problem set §1.4, exercises 1, 17, 22, 24, 30, 41, 42

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IV. Factor the following matrices into $LU$ form.

(a) $\begin{bmatrix} 2 & -3 \\ 4 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 2 & -3 \\ 1 & -3 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 4 & 5 \\ 0 & 4 & 0 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 0 & 1 \\ 2 & 2 & 2 \\ 3 & 4 & 5 \end{bmatrix}$

V. Use your decomposition from part 1(d) to solve each system. (Do not use elimination again! Instead rewrite each system as two triangular systems and back-solve twice.)

(a) $\begin{cases} x + z = 4 \\ 2x + 2y + 2z = 4 \\ 3x + 4y + 5z = 6 \end{cases}$

(b) $$\begin{cases} x \phantom{{}+2y} + z = 2 \\ 2x + 2y + 2z = 6 \\ 3x + 4y + 5z = 14 \end{cases}$$

VI. Factor the *tridiagonal* matrix $A$ into $A = LU$.

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$

VII. Problem set §1.5, exercises 11, 20, 21, 22, 23, 24