

Homework II

Score EAS01

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$$A = \left[\begin{array}{cc|cc} 1 & 2 & 0 & 0 \\ 3 & 4 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 3 \end{array} \right] \quad \left. \begin{array}{l} R_2 \rightarrow R_2 - 3R_1 \\ R_2 \rightarrow R_2 / -2 \end{array} \right\}$$

$$\left[\begin{array}{cc|cc} 1 & 2 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 3 \end{array} \right] \quad \left. \begin{array}{l} R_1 \rightarrow R_1 - 2R_2 \end{array} \right\}$$

$$\left[\begin{array}{cc|cc} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{array} \right] \quad \left. \begin{array}{l} R_4 \rightarrow R_4 - 2R_3 \\ R_5 \rightarrow R_5 / 3 \end{array} \right\}$$

A^{-1}

$$A^{-1} = \left[\begin{array}{ccccc} -2 & 1 & 0 & 0 & 0 \\ 3/2 & -1/2 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & -2 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1/3 \end{array} \right]$$

$$B = \left[\begin{array}{cc|cc} 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{array} \right] \quad \left. \begin{array}{l} R_1 \rightarrow R_5/10 + R_1 \\ R_2 \rightarrow R_4/5 + R_2 \\ R_4 \rightarrow -5R_2 + R_4 \\ R_5 \rightarrow -10R_1 + R_5 \end{array} \right\}$$

$$\left[\begin{array}{cc|cc} 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 2 & 0 & 0 & 1 & 0 & 1 & 5 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1/4 & 0 & 0 \\ 0 & 0 & 0 & -10 & 0 & 0 & 0 & 5 & 0 & 0 \\ 0 & 0 & 0 & 0 & -10 & 0 & -10 & 0 & 0 & 0 & 0 \end{array} \right] \quad \left. \begin{array}{l} R_2 \rightarrow R_4/5 + R_2 \\ R_5 \rightarrow R_1 - 10 + R_5 \end{array} \right\}$$

$$\left[\begin{array}{cc|cc} 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 5 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1/4 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1/2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \end{array} \right]$$

$$B^{-1} = \left[\begin{array}{ccccc} 0 & 0 & 0 & 0 & 1/10 \\ 0 & 0 & 0 & 1/5 & 0 \\ 0 & 0 & 1/4 & 0 & 0 \\ 0 & 1/2 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{array} \right]$$

2. a)

$$\left[\begin{array}{cccc|cccc} 1 & -1 & 0 & 0 & 1 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 & 1 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 & 0 & 1 & 0 \\ 0 & 0 & -1 & 2 & 0 & 0 & 0 & 1 \end{array} \right]$$

$$\left[\begin{array}{cccc|cccc} 1 & -1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & -1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & -1 & 1 & 1 & 1 & 0 \\ 0 & 0 & -1 & 2 & 0 & 0 & 0 & 1 \end{array} \right]$$

$$\left[\begin{array}{cccc|cccc} 1 & -1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & -1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 2 & 2 & 2 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \end{array} \right]$$

$$\left[\begin{array}{cccc|cccc} 1 & 0 & 0 & 0 & 4 & 3 & 2 & 1 \\ 0 & 1 & 0 & 0 & 3 & 3 & 2 & 1 \\ 0 & 0 & 1 & 0 & 2 & 2 & 2 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \end{array} \right]$$

$$C^{-1} = \begin{bmatrix} 4 & 3 & 2 & 1 \\ 3 & 3 & 2 & 1 \\ 2 & 2 & 2 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

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2. b)

$$\left[\begin{array}{ccc|ccc} 1 & -2 & 0 & 1 & 0 & 0 \\ -2 & 5 & 4 & 0 & 1 & 0 \\ -3 & 6 & 1 & 0 & 0 & 1 \end{array} \right]$$

$$\left[\begin{array}{ccc|ccc} 1 & -2 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 4 & 2 & 1 & 0 & 0 \\ 0 & 0 & 1 & 3 & 0 & 1 & 0 \end{array} \right]$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & -19 & 2 & 8 \\ 0 & 1 & 0 & 1 & -10 & 1 & -4 \\ 0 & 0 & 1 & 3 & 0 & 1 & 0 \end{array} \right]$$

$$D^{-1} = \begin{bmatrix} -19 & 2 & 8 \\ -10 & 1 & -4 \\ 3 & 0 & 1 \end{bmatrix}$$

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3.

$$F = \begin{bmatrix} 1 & 2 & 1 & 3 \\ 4 & 9 & 6 & 5 \\ 5 & 12 & 8 & 15 \\ 2 & 7 & 6 & 7 \end{bmatrix} \rightarrow E_{21} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ -4 & 1 & 0 & 0 \\ 0 & 5 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 & 3 \\ 0 & 1 & 2 & -7 \\ 0 & 2 & 3 & 0 \\ 2 & 7 & 6 & 7 \end{bmatrix} \rightarrow E_{31} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ -5 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 & 3 \\ 0 & 1 & 2 & -7 \\ 0 & 2 & 3 & 0 \\ 0 & 3 & 4 & -1 \end{bmatrix} \rightarrow E_{41} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -2 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 & 3 \\ 0 & 1 & 2 & -7 \\ 0 & 0 & -1 & 14 \\ 0 & 3 & 4 & 1 \end{bmatrix} \rightarrow E_{32} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & -2 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 & 3 \\ 0 & 1 & 2 & -7 \\ 0 & 0 & -1 & 14 \\ 0 & 0 & 0 & -6 \end{bmatrix}$$

$$E_{42} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & -3 & 0 & 1 \end{bmatrix}$$

$$E_{43} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & -2 & 1 \end{bmatrix}$$

→ pivots: 1, 1, -1, -6

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4.

$$A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 8 & -2 \\ 5 & 11 & -5 \end{bmatrix}$$

$$\left[\begin{array}{ccc|ccc} 1 & 2 & -1 & 1 & 0 & 0 \\ 3 & 8 & -2 & 0 & 10 & 0 \\ 5 & 11 & -5 & 0 & 0 & 1 \end{array} \right] \rightarrow \left[\begin{array}{cccccc} 1 & 2 & -1 & 1 & 0 & 0 \\ 0 & 2 & 1 & 1 & -3 & 0 \\ 0 & 1 & 0 & 1 & -5 & 0 \end{array} \right]$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & -1 & 1 & 1 & 0 & -2 \\ 0 & 0 & 1 & 7 & 1 & -2 & 1 \\ 0 & 1 & 0 & -5 & 0 & 1 & -2 \end{array} \right] \rightarrow \left[\begin{array}{cccccc} 1 & 0 & 0 & 1 & 8 & 1 & -4 \\ 0 & 1 & 0 & -5 & 0 & 1 & 1 \\ 0 & 0 & 1 & -7 & 1 & -2 & -2 \end{array} \right]$$

$$\vec{x} = \begin{bmatrix} 18 & 1 & -4 \\ -5 & 0 & 1 \\ 7 & 1 & -2 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} = \begin{bmatrix} 8 \\ -2 \\ 3 \end{bmatrix}$$

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5.

$$F = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 5 & 10 & 14 \\ 3 & 10 & 26 & 39 \\ 4 & 14 & 39 & 62 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 1 & 4 & 6 \\ 0 & 4 & 17 & 27 \\ 0 & 6 & 27 & 46 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 1 & 4 & 6 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 3 & 10 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 1 & 4 & 6 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} = U$$

$$L = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 2 & 1 & 0 & 0 \\ 3 & 4 & 0 & 0 \\ 4 & 6 & 3 & 1 \end{bmatrix}$$

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