Assignment 2

MATH 3110
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1. a) Matrix B is in echelon form, as the first nonzero entry in each row has 0's below it, and every all-zero row (Row 4) is below the other rows.

b) Matrix B is not in reduced row echelon form simply because the pivot for row 3 is not 1.

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2. a) The two matrices are row-equiv. because they can be transformed into each other using only the standard row operations:

$$(M_a \to M_b) \quad \begin{aligned} R'1 &= R1 \\ R'2 &= R1 + R2 \\ R'3 &= 2R3 \end{aligned}$$

b) Assuming the two matrices are indeed row-equiv. allows us to easily reduce the second matrix into RR echelon form:

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 5 - 2(5) - 12(5) - 11(3) \\ 0 & 1 & 0 & 20 + 6(5) + 6(5) + 2(3) \\ 0 & 0 & 1 & 4 + 0(5) + 0(5) + 0(3) \end{array}\right]$$

... which is a different solution set than matrix one. Therefore, the two matrices must not be row-equiv.

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3. $F' \left| \begin{array}{l} R'1 = \frac{1}{5}R1 \\ R'2 = R1 - R2 \\ R'3 = R1 - R3 \end{array} \right. = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

$G' \left| \begin{array}{l} R'1 = R1 - 3R'2 \\ R'2 = \frac{1}{2}(R2 - 5R1) \end{array} \right. = \begin{bmatrix} 1 & 2 & 0 & -28 \\ 0 & 0 & 1 & 6 \end{bmatrix}$

$H' \left| \begin{array}{l} R'1 = \frac{1}{4}R4 \\ R'2 = R1 \\ R'3 = \frac{1}{2}R2 \\ R'4 = \frac{1}{3}R3 \end{array} \right. = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

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4. $M = \left[\begin{array}{cccc|c} 3 & 6 & 5 & -2 & 2 \\ 3 & 6 & 6 & 1 & 3 \\ 3 & 6 & 7 & 4 & 4 \end{array}\right] \begin{array}{l} R'1 = \frac{1}{3}R1 \\ R'2 = R2 - R1 \\ R'3 = R3 - R2 \end{array}$

$= \left[\begin{array}{cccc|c} 1 & 2 & \frac{5}{3} & -\frac{2}{3} & \frac{2}{3} \\ 0 & 0 & 1 & 3 & 1 \\ 0 & 0 & 1 & 3 & 1 \end{array}\right] \begin{array}{l} R'1 = R1 - \frac{5}{3}R2 \\ R'2 = R2 \\ R'3 = R3 - R2 \end{array}$

$= \left[\begin{array}{cccc|c} 1 & 2 & 0 & -\frac{17}{3} & -1 \\ 0 & 0 & 1 & 3 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right]$

* This system is consistent because all zero-only rows have 0 in the aug. column

As the system is consistent and in row reduced echelon form, the system has solutions

$$a = -1 - 2b + \frac{17}{3}d$$

$$c = 1 - 3d$$

... which are infinitely many solutions.