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3/26/2023
AE 227 - Engineering Digital Computation

1.

$$\begin{bmatrix} -2 & 1 & 4 \\ 5 & 3 & 0 \\ 4 & 6 & -3 \end{bmatrix} = \begin{bmatrix} 7 \\ 1 \\ 4 \end{bmatrix}$$

$R_2 = 5R_1 + R_2 \cdot 2$
$R_3 = R_3 + R_1 \cdot 2$

$$\begin{bmatrix} -2 & 1 & 4 \\ 0 & 11 & 20 \\ 0 & 8 & 5 \end{bmatrix} = \begin{bmatrix} 7 \\ 36 \\ 18 \end{bmatrix}$$

$R_3 = \cancel{11R_3} - 8R_2$

$$\begin{bmatrix} -2 & 1 & 4 \\ 0 & 11 & 20 \\ 0 & 0 & -105 \end{bmatrix} = \begin{bmatrix} 7 \\ 36 \\ -90 \end{bmatrix}$$

$R_3 = R_3 / -105$

$$\begin{bmatrix} -2 & 1 & 4 \\ 0 & 11 & 20 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 7 \\ 36 \\ 6/7 \end{bmatrix}$$

$\therefore z = 76$

$11y + 20z = 36$ $\qquad 11y + 20(76) = 36$

$-2x + y + 4z = 7$

$$x = \frac{7 - 4(76) + \frac{1484}{11}}{-2}$$

$$\boxed{\begin{aligned} y &= -\frac{1484}{11} \\ z &= 76 \\ x &= \frac{1783}{22} \end{aligned}}$$

2.

$$7x+8y+9z=6$$
$$4x+5y+6z=3$$
$$x+2y+3z=0$$

$$\begin{bmatrix} 7 & 8 & 9 \\ 4 & 5 & 6 \\ 1 & 2 & 3 \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \\ 0 \end{bmatrix}$$

$R_1 = (R_1/7)$

$$\begin{bmatrix} 1 & 8/7 & 9/7 \\ 4 & 5 & 6 \\ 1 & 2 & 3 \end{bmatrix} = \begin{bmatrix} 6/7 \\ 3 \\ 0 \end{bmatrix}$$

$R_2 = R_2 - (R_1 \cdot 4)$

$$\begin{bmatrix} 1 & 8/7 & 9/7 \\ 0 & 3/7 & 6/7 \\ 1 & 2 & 3 \end{bmatrix} = \begin{bmatrix} 6/7 \\ -3/7 \\ 0 \end{bmatrix}$$

$R_3 = R_3 - R_1$

$$\begin{bmatrix} 1 & 8/7 & 9/7 \\ 0 & 3/7 & 6/7 \\ 0 & 6/7 & 12/7 \end{bmatrix} = \begin{bmatrix} 6/7 \\ -3/7 \\ -6/7 \end{bmatrix}$$

$R_2 = R_2 \cdot (\frac{1}{3})$

$$\begin{bmatrix} 1 & 8/7 & 9/7 \\ 0 & 1 & 2 \\ 0 & 6/7 & 12/7 \end{bmatrix} = \begin{bmatrix} 6/7 \\ -1 \\ -6/7 \end{bmatrix}$$

$R_3 = R_3 - R_2(6/7)$

$$\begin{bmatrix} 1 & 8/7 & 9/7 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 6/7 \\ -1 \\ 0 \end{bmatrix}$$

$R_1 = R_1 - R_2(8/7)$

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

$\therefore$ $x - z = 2$

$y + 2z = -1$

$R_1 = R_1 \cdot (0.571)$

a.

$$\begin{bmatrix} 0.571 & 0 & -0.571 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1.142 \\ -1 \\ 0 \end{bmatrix}$$

$R_2 = R_2 - R_1$

$$\begin{bmatrix} 0.571 & 0 & -0.571 \\ -0.571 & 1 & 2.571 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1.142 \\ -0.429 \\ 0 \end{bmatrix}$$

$\therefore$ $0.571x - 0.571z = 1.142$

$0.571x + y + 2.571z = -0.429$

6.

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

$\therefore$ $y+2z=-1$

$x-z=2$

* Still an infinite number of solutions. Changing the ordering of the rows without changing the contents of the rows shouldn't change the result.