Week 4 Wednesday

January 29, 2020 10:59 AM

Office Hours CBA 151

Fri 7:45 - 8:30 am

2.4 Applications

See Handout

Omit #2, 5

③ Let $w(NH_3) + x(O_2) \to y(N_2) + z(H_2O)$

N: $w = 2y \to w - 2y = 0$

H: $3w = 2z \quad 3w - 2z = 0$

O: $2x = z \quad 2x - z = 0$

$$\begin{array}{c} w\ \ x\ \ y\ \ z \\ \left[\begin{array}{cccc|c} 1 & 0 & -2 & 0 & 0 \\ 3 & 0 & 0 & -2 & 0 \\ 0 & 2 & 0 & -1 & 0 \end{array}\right] \end{array}$$

$$\rightsquigarrow \begin{array}{c} w\ \ x\ \ y\ \ z \\ \left[\begin{array}{cccc|c} 1 & 0 & 0 & -\frac{2}{3} & 0 \\ 0 & 1 & 0 & -1/2 & 0 \\ 0 & 0 & 1 & -1/3 & 0 \end{array}\right] \end{array} \quad \text{RREF}$$

$z = t$

$w - \frac{2}{3}z = 0 \rightsquigarrow$ $w = \frac{2}{3}t$

$x = \frac{1}{2}t$

$y = \frac{1}{3}t$

Want positive integer values
Choose smallest t

$t = 6$

$w = 4 \quad x = 3 \quad y = 2 \quad z = 6$

$$4\,NH_3 + 3\,O_2 \rightarrow 2\,N_2 + 6\,H_2O$$

(4) a) Inflow = outflow at each intersection

A: $20 = f_1 + f_2$

B: $f_1 + f_3 = 25$

C: $30 = f_3 + f_4$

D: $f_2 + f_4 = 25$

$$\begin{array}{c} \begin{matrix} f_1 & f_2 & f_3 & f_4 \end{matrix} \\ \left[\begin{array}{cccc|c} 1 & 1 & 0 & 0 & 20 \\ 1 & 0 & 1 & 0 & 25 \\ 0 & 0 & 1 & 1 & 30 \\ 0 & 1 & 0 & 1 & 25 \end{array}\right] \end{array}$$

$$\rightsquigarrow \quad \begin{matrix} f_1 & f_2 & f_3 & f_4 \end{matrix} \quad \left[\begin{array}{cccc|c} 1 & 0 & 0 & -1 & -5 \\ 0 & 1 & 0 & 1 & 25 \\ 0 & 0 & 1 & 1 & 30 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right] \quad \text{RREF}$$

$f_4 = t$ $\quad (t \geq 0)$

$f_1 - f_4 = -5$

$f_1 = t - 5$ $\quad (t - 5 \geq 0 \Rightarrow t \geq 5)$

$f_2 = 25 - t$ $\quad (25 - t \geq 0 \Rightarrow 25 \geq t \Rightarrow t \leq 25)$

$f_3 = 30 - t$ $\quad (t \leq 30)$

Want nonnegative values

$$5 \leq t \leq 25$$

b) $f_4 = 10 \implies t = 10$

$f_1 = 5 \quad f_2 = 15 \quad f_3 = 20$

c) Use $t = 5$ and $t = 25$:

$$5 \leq f_4 \leq 25$$

$$0 \leq f_1 \leq 20$$

$$0 \leq f_2 \leq 20$$

$$5 \leq f_3 \leq 25$$