Problem 5

$kmol := 10^3\ mol$

$x_0 := 0.2$ $x_2 := 0.01$ $X_0 := \frac{x_0}{1-x_0} = 0.25$ $X_2 := \frac{x_2}{1-x_2} = 0.01$

$L_0 := 100\ \frac{kmol}{hr}$ $L_s := L_0 \cdot (1 - x_0) = 80\ \frac{kmol}{hr}$

Solve Guess Values Constraints

$V_{smin} := 100\ \frac{kmol}{hr}$ $\frac{0.975 - 0}{0.25 - 0.01} = \frac{L_s}{V_{smin}}$

$V_{smin} := \text{find}(V_{smin}) = 19.692\ \frac{kmol}{hr}$

$V_s := 1.4\ V_{smin} = 27.569\ \frac{kmol}{hr}$ $\frac{0.975}{1.4} = 0.696$ $y_0 := 0$ $Y_0 := y_0$

Solver Constraints Values

$Y_2 := 0.5$ $y_2 := .1$

$Y_2 = \frac{y_2}{1-y_2}$ $X_0 \cdot L_s + Y_0 \cdot V_s = X_2 \cdot L_s + Y_2 \cdot V_s$

$\begin{bmatrix} Y_2 \\ y_2 \end{bmatrix} := \text{find}(Y_2, y_2) = \begin{bmatrix} 0.696 \\ 0.41 \end{bmatrix}$

Problem 6

$cmHg := 10\ torr$ $\quad Ba := \dfrac{cm^3 \cdot cm}{cm^2 \cdot s \cdot cmHg}$ $\quad F := 100\ \dfrac{m^3}{min}$

$P2 := 1\ atm$ $\quad P1 := 40\ atm$ $\quad Z := .1 \cdot 10^{-6}\ m$ $\quad PmA := \dfrac{56\ Ba}{10^{10}}$ $\quad PmB := \dfrac{7.47\ Ba}{10^{10}}$

$xFA := 66.7\%$ $\quad yA := 90\%$ $\quad r := \dfrac{P2}{P1}$ $\quad \alpha AB := \dfrac{PmA}{PmB}$

$L := 1\ \dfrac{m^3}{s}$ $\quad V := 1\ \dfrac{m^3}{s}$ $\quad xA := .5$

$F = L + V$ $\quad xFA \cdot F = xA \cdot L + yA \cdot V$

$$yA = \frac{\alpha AB \cdot (xA - r \cdot yA)}{\alpha AB \cdot (xA - r \cdot yA) + ((1 - xA) - r \cdot (1 - yA))}$$

$$\begin{bmatrix} L \\ V \\ xA \end{bmatrix} := \text{find}(L, V, xA) = \begin{bmatrix} 1.124\ \dfrac{m^3}{s} \\ 0.543\ \dfrac{m^3}{s} \\ 0.554 \end{bmatrix}$$

$L = 67.424\ \dfrac{m^3}{min}$ $\quad V = 32.576\ \dfrac{m^3}{min}$

$$Area := \frac{V \cdot yA}{\frac{PmA}{Z}(P1 \cdot xA - P2 \cdot yA)} = 53.96\ m^2$$

$xB := 1 - xA = 0.446$

Problem 7

$x0 := 4.2 \cdot 10^{-4}$ $\quad xn := 2 \cdot 10^{-5}$ $\quad L := 760 \ \frac{kmol}{hr}$

$X0 := \frac{x0}{1 - x0} = 0.000420176$ $\quad Xn := \frac{xn}{1 - xn} = 0.00002$ $\quad Ls := L \cdot (1 - x0) = 759.681 \ \frac{kmol}{hr}$

Given

$Vs := 1 \ \frac{kmol}{hr}$ $\quad \frac{.068}{.00042 - .00002} = \frac{Ls}{Vs}$

Solve

$Vs\_min := \text{find}(Vs) = 4.469 \ \frac{kmol}{hr}$

$Vs := Vs\_min \cdot 1.4 = 6.256 \ \frac{kmol}{hr}$

$\frac{.068}{1.4} = 0.049$

Problem 8

$F := 150 \ \frac{kmol}{hr}$ $\quad xD := 98\%$ $\quad xF := 40\%$ $\quad xB := 1\%$

Guess Values

$D := 10 \ \frac{kmol}{hr}$ $\quad B := 10 \ \frac{kmol}{hr}$

Constraints

$F \cdot xF = D \cdot xD + B \cdot xB$ $\quad F = D + B$

Solve

$\begin{bmatrix} D \\ B \end{bmatrix} := \text{find}(D, B) = \begin{bmatrix} 60.309 \\ 89.691 \end{bmatrix} \frac{kmol}{hr}$

Guess Values

$R_{min} := 2$

Constraints

$\frac{R_{min}}{R_{min} + 1} = \frac{xD - 0.65}{xD - xF}$

Solver

$R_{min} := \text{find}(R_{min}) = 1.32$

$R := 4$ $\quad y := \frac{xD}{R + 1} = 0.196$