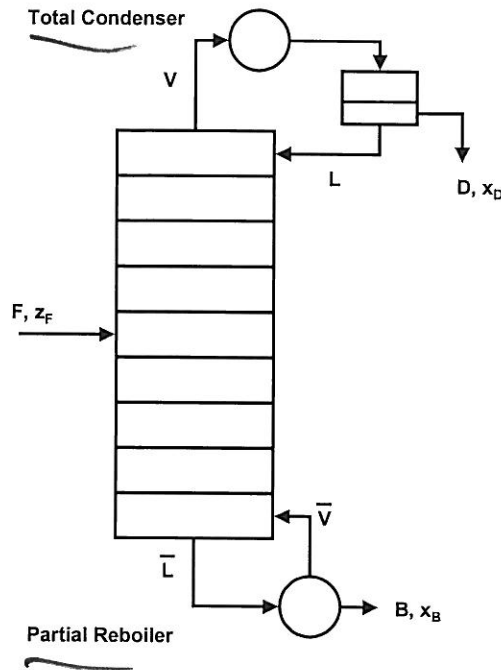# CHE 305 – Separation Processes
Spring 2010 – In Class Exercise on Distillation III

Given the XY phase diagram for separation of a binary mixture, determine:

a. x_D and x_B

$$X_D = 0.98 \qquad X_B = 0.05$$

b. the reflux and boilup ratios

Rop: $\dfrac{0.7 - 0.98}{0.5 - 0.98} = 0.583 = \dfrac{R}{R+1} \Rightarrow$

$R = 0.583R + 0.583$

$0.417 R = 0.583$

$\boxed{R = 1.4}$

Sop: $\dfrac{0.05 - 0.7}{0.05 - 0.5} = 1.44 = \dfrac{V_B + 1}{V_B} \Rightarrow 1.44 V_B = V_B + 1$

$0.44 V_B = 1$

The feed enters at the optimum location, and the percent vaporization of the feed stream is 40%. What is the feed composition? What is the location of the feed tray?

$\Rightarrow \boxed{V_B = 2.27}$

$\Psi = 0.4 \qquad \text{Slope} = \dfrac{\Psi - 1}{\Psi} = \dfrac{0.4 - 1}{0.4} = \dfrac{-0.6}{0.4} = -\dfrac{3}{2}$

$Z = 0.58$

XY Phase Diagram

$x_B = 0.98$

(0.5, 0.7)

$z = 0.58$

⟹ 5 theoretical Stages

Partial Reboiler

$x_B = 0.05$

y_A

x_A