# Exercise Problem 1

Find minimum number of stages using Fenske equation.

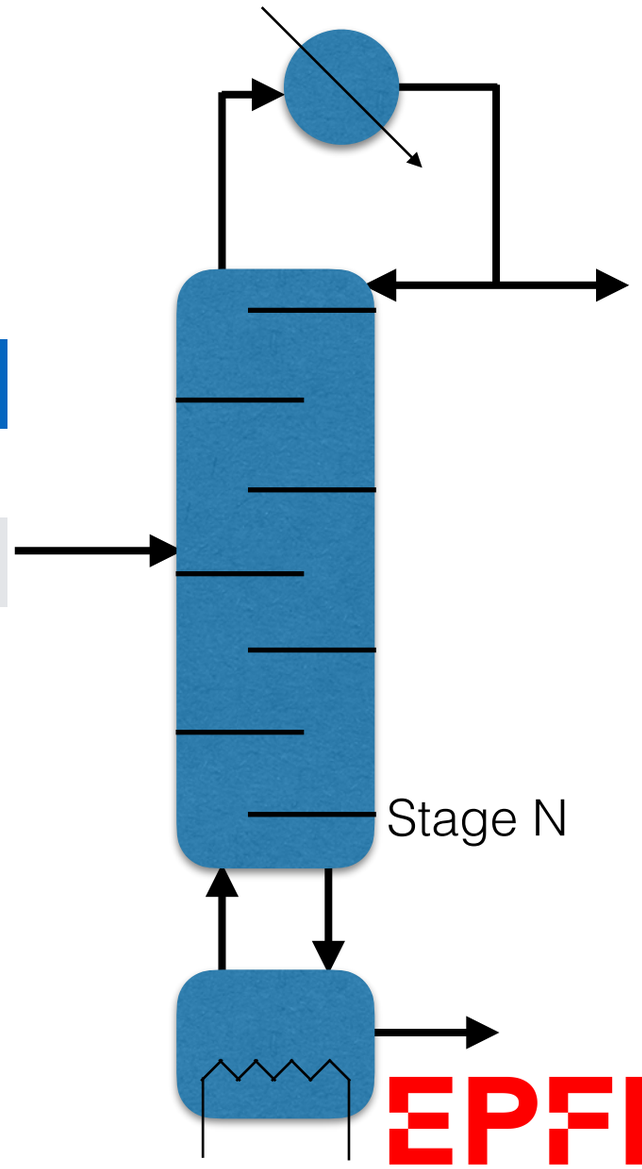
$$N_{\min} = \frac{\ln\left[\left(\frac{FR_D^{(1)}}{1-FR_D^{(1)}}\right)\left(\frac{FR_B^{(2)}}{1-FR_B^{(2)}}\right)\right]}{\ln\left(\alpha_{average}^{(12)}\right)}$$

What is expected fractional recovery of benzene in distillate and bottom.

$$FR_D^{(3)} = \frac{\left(\alpha_{average}^{(32)}\right)^{N_{\min}}}{\left(\alpha_{average}^{(32)}\right)^{N_{\min}} + \left(\frac{FR_B^{(2)}}{1-FR_B^{(2)}}\right)}$$

Find fractional recovery of benzene in distillate and bottom

| | | % in feed |
|---|---|---|
| **Benzene** | 80.1 °C | 40% |
| **Toluene** | 110. 6 °C | 30% |
| **Cumene** | 152.4 °C | 30% |




$$FR_D^{(Toluene)} = 95\%$$

$$\alpha_{average}^{(Benzene-Toluene)} = 2.25$$

$$\alpha_{average}^{(Cumene-Toluene)} = 0.21$$

$$FR_B^{(Cumene)} = 95\%$$

EPFL

# Exercise Problem 2

**A three component feed (100 mole/hr, saturated vapor, LNK 3%, LK 50%, HK 47%) is to be separated in a distillation column. Desired recovery for LK in distillate is 90%. Assume constant relative volatility.**

$D = 50 \text{ mole/hr}$ $\alpha^{(LNK,HK)} = 10$ $\alpha^{(HK,LK)} = 0.4$

1. Calculate minimum number of stages by the Fenske method.
2. If R = 2 $R_{min}$, and $R_{min}$ =2, calculate the number of stages by Gilliland method.

$$N_{\min} = \frac{\ln\left[\left(\frac{FR_D^{(1)}}{1-FR_D^{(1)}}\right)\left(\frac{FR_B^{(2)}}{1-FR_B^{(2)}}\right)\right]}{\ln\left(\alpha_{average}^{(12)}\right)}$$