Problem 21 (due Friday, November 12th)

A separations unit is designed to operate in steady state so that equilibrium is reached within a main tank at a temperature of 50 ℃. There is one inlet which feeds a binary liquid mixture to the tank. The inlet flow rate is 60 mol/s which is 50 mol % in each component. The outlet vapor flow rate is 20 mol/s.

Case #1: The inlet has components 1 and 2 and there are three outlets from the tank:

I. a binary ideal gas mixture of component 1 and component 2.
II. a pure liquid phase of component 1
II   a pure liquid phase of component 2, which is immiscible with component 1.

Case # 2: The inlet has components 1 and 3 and there are three outlets from the tank:

I   an ideal vapor phase
II   a pure liquid phase of component 1
III   a pure liquid phase of component 3, which is immiscible with component 1.

Case # 3: The inlet has components 1 and 2 and there are two outlets from the tank:

I   an ideal vapor phase
II   a binary liquid phase ideal solution mixture

Case # 4: The inlet has components 1 and 3 and there are two outlets from the tank:

I   an ideal vapor phase
II   a binary liquid phase ideal solution mixture

c) For each of the four cases, draw the system and determine the pressure in the tank, and the composition and flow rates of all the outlet streams.

component 1: $P_1{}^{sat}$(25 ℃)=10 kPa

component 2: $P_2{}^{sat}$(25 ℃)=90 kPa

component 3: $P_3{}^{sat}$(25 ℃) ~ 0 (nonvolatile)