10.32
Spring 2005
Problem Set 1
Due Friday, February 11, 2005

Problem 1 Exercise 4.6 in S & H

Problem 2 (see attached)

Please hand in each problem separately

Problem 2

Consider a mixture of five hydrocarbons, which can be considered to form ideal mixtures in both the liquid and vapor phases. The composition of the mixture is given below, along with constants for each pure hydrocarbon for the vapor pressure function $\ln(P) = A - D/T$, where P is in atmospheres and T is in Kelvins.

Component	z	A	D
C3	0.2	9.816	2260
C4	0.1	9.922	2696
C5	0.2	10.173	3141
C6	0.3	10.264	3496
C7	0.2	10.465	3890

The mixture is passed through a continuous steady-state flash unit at an outlet pressure of six atmospheres. The liquid and vapor streams leaving the unit are in equilibrium with each other. Appropriate energy interaction with the environment is provided.

a) Over what range of outlet temperatures will the output from the flash unit include both a liquid and a vapor phase? What are the compositions of the liquid and vapor phases at the extremes of this temperature range?

b) If the outlet temperature is midway between those found in a) above, what fraction of the outlet flow is vapor? What are the compositions of the liquid and vapor phases?

c) If it is desired that 90% of the C3's in the feed leave in the vapor stream, what are the compositions of the vapor and liquid streams? What is the outlet temperature?

d) Consider a mixture containing one-fourth each of C3, C4, C5, and helium. Helium may be considered completely non-condensable. The mixture is passed through a flash unit as in Problem 2a and 2b leaving the unit as six atmospheres pressure. How would you determine the answers to questions 2a and 2b? You do not need to solve for the temperatures and compositions. Carefully consider the values you would substitute into the Ratchford-Rice Flash Function.