Bonus.1

A liquid/vapor mixture (q=0.5) stream at 100 kgmol/h containing 22% ethanol and 78% water has been generated from a yeast fermentation and is fed into a distillation column. The reflux ratio is 3.0.

a) How many theoretical plates are needed to achieve a distillate of 80% ethanol and a bottoms of 2% ethanol?
b) Under the conditions of part a), at what stage should the feed be introduced?
c) What is the minimum reflux ratio that will allow this separation (i.e., with an infinite number of stages)?

I advise you to construct two plots...one having a scale on both axes of 0 – 1, and a second having a scale on both axes of 0.6 – 0.9.

Equilibrium data (These data are also available on the homework website as an excel file "ethanol-water")

0.0000	0.0000
0.0160	0.1470
0.0315	0.2505
0.0600	0.3765
0.0855	0.4300
0.1465	0.5005
0.2060	0.5415
0.2360	0.5600
0.3495	0.5945
0.4675	0.6410
0.4875	0.6425
0.5800	0.6890
0.6525	0.7250
0.7000	0.7495
0.7175	0.7680
0.7890	0.8111
0.8420	0.8488
0.8749	0.8768
0.8967	0.8973
0.9485	0.9440
0.9727	0.9692
1.0000	1.0000