

CE 407 Separations

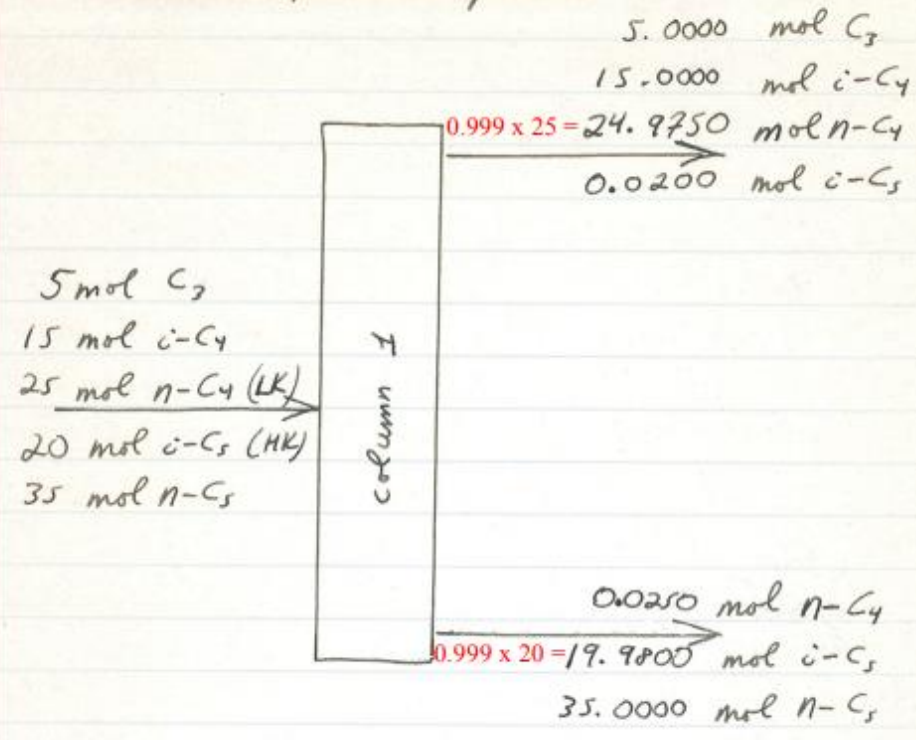
Multicomponent distillation column sequencing

A stream in a refinery has the following composition:

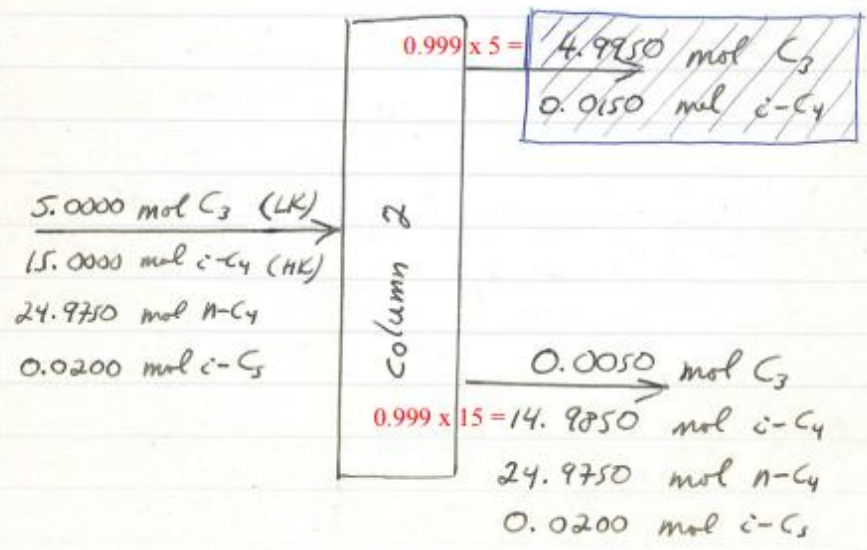
component	mole fraction
C ₃	0.05
<i>i</i> -C ₄	0.15
<i>n</i> -C ₄	0.25
<i>i</i> -C ₅	0.20
<i>n</i> -C ₅	0.35

Prepare a flow sheet for a four-column plant that will isolate all five components. Your design must begin with a butane-pentane splitter but subsequent splits can be chosen freely. Assume 99.9 percent recovery of light and heavy keys in distillate and bottoms in each column. Calculate mole numbers for all streams. Determine the purities of all five products. State any assumptions you make.

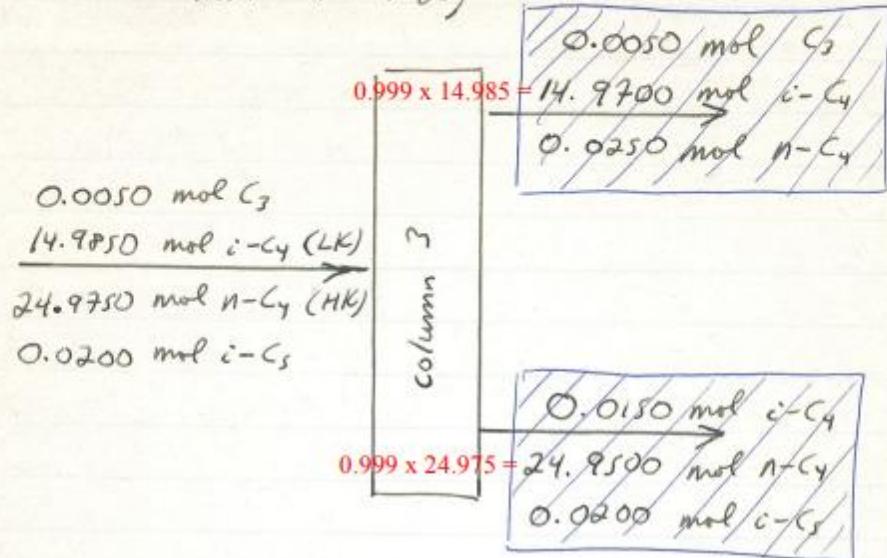
(i) butane - pentane splitter



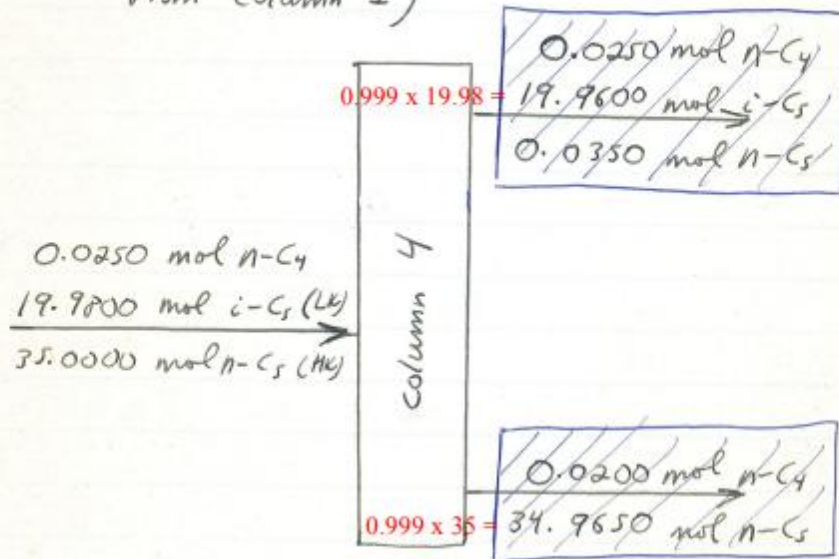
(ii) depropanizer (feed is distillate from column 1)



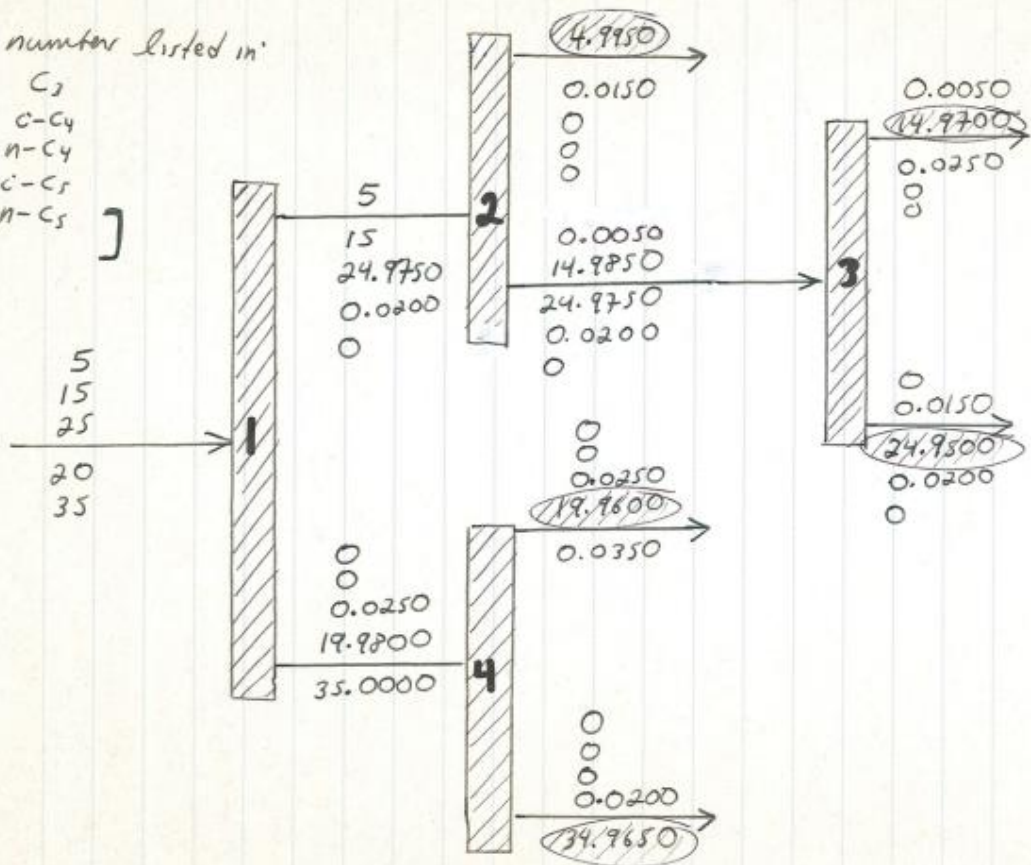
(iii) i-C₄/n-C₄ splitter (feed is bottom product from column 2)



(iv) i-C₅/n-C₅ splitter (feed is bottom product from column 1)



[Mole number listed in:
order C₃
C-C₄
n-C₄
C-C₅
n-C₅]



[4]

Have made usual assumption that component(s) heavier than HK absent from distillate, component(s) lighter than LK absent from bottom product.

Final product purities are as follows:

- C₃: 99.70%
- C-C₄: 99.80%
- n-C₄: 99.86%
- C-C₅: 99.70%
- n-C₅: 99.94%