CH3030 Tutorial 4

1. A continuous distillation with a reflux ratio (L/D) of 3.5 yields a distillate containing 97 wt% B (benzene) and a bottoms of 98 wt% T (toluene). Due to weld failures, the 10 stripping plates in the bottom section of the column are ruined, but the 14 upper rectifying plates are intact. It is suggested that the column still be used, with the feed (F) as saturated vapor at the dew point, with F=13,600 kg/h containing 40 wt% B and 60 wt% T. Assuming that the plate efficiency remains unchanged at 50%:
(a) Can this column still yield a distillate containing 97 wt% B?
(b) How much distillate is there?
(c) What is the residue composition in mole %?

VLE data for B-T mixture is

y	0.21	0.37	0.51	0.64	0.72	0.79	0.86	0.91	0.96	0.98
x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95

2. A solution of CCl4 and CS2 containing 50 wt% each is to be continuously fractionated at standard atmospheric pressure at the rate of 4000 kg/h. The distillate product is to contain 95 wt% CS2 and the residue to contain 0.5 wt%. The feed will be 30 mol% vaporized before it enters the tower. A total condenser will be used and the reflux will be returned at the bubble point. Equilibrium data x,y CS2 is provided below

T (°C)	x	y
76.7	0	0
74.9	0.0296	0.0823
73.1	0.0615	0.1555
70.3	0.1106	0.266
68.6	0.1435	0.3325
63.8	0.2585	0.495
59.3	0.3908	0.634
55.3	0.5318	0.747
52.3	0.663	0.829
50.4	0.7574	0.878
48.5	0.8604	0.932
46.3	1	1

(a) Determine the product rates in kg/h
(b) Determine the minimum reflux ratio
(c) Determine the minimum number of theoretical trays
(d) Determine the number of theoretical trays required at a reflux ratio equal to twice the minimum
(e) Determine the optimum position of the feed tray