CH3030 Tutorial 5

1. An aqueous solution of ethanol (30 mass% ethanol) is to be enriched into a top product having 88 mass% alcohol. The bottom product must not contain more than 4 mass% ethanol. The feed enters the column at 40°C at a rate of 5000 kg/h. The reflux is at its bubble point and the reflux ratio is 1. Determine

a) The number of ideal trays required using the Ponchon-Savarit method
b) The heat duty of the condenser and the reboiler.

The enthalpy concentration (kJ/kmol; reference states: pure liquids at 0°C) and the vapour liquid equilibrium data at the operating pressure of 1 atm are given below

x,y	0	0.0417	0.0891	0.146	0.207	0.281	0.37	0.477	0.61	0.779	1
H_L	7540	7125	6880	6915	7097	7397	7750	8105	8471	8945	9523
H_V	48150	48250	48300	48328	48436	48450	48450	48631	48694	48950	

x	0	0.00792	0.0016	0.0202	0.0417	0.0891	0.1436	0.281	0.37	0.477	0.61	0.641	0.706	0.779	0.86	0.904	0.95	1
y	0	0.0850	0.1585	0.191	0.304	0.427	0.493	0.568	0.603	0.644	0.703	0.72	0.756	0.802	0.864	0.902	0.9456	1

Enthalpy of the feed is 4790 kJ/kmol.