Question 1

An equimolar feed stream consisting of Benzene and Toluene enters in a distillation column having a flow rate of 100 kmol/h at 25°*C* and 1 atm pressure. This feed is required to fractionate in a distillation column capable of recovering at least 99.5% of the light key component in the distillate and 99.5% of the heavy key component in the bottoms. The distillation column is operated at 1 atm pressure with a 0.01 atm pressure drop on each tray. The distillation column has 3 times the minimum number of trays calculated from *DSTWU* model (including the condenser and the reboiler) and a total condenser operates at 1 atm pressure. The thermodynamic method used to simulate the distillation column is the Peng Robinson method.

1. Simulate the column and neatly draw the material and energy balance flows on the column.
2. Plot the temperature and composition profile of the column.

Question 2

Consider the BTX (Benzene-Toluene-Xylene) separation process as shown in Figure 1. The first column recovers benzene as the distillate with toluene and xylene leaving down the bottoms. The second column processes this bottoms to recover toluene up the top and xylene down the bottom. Since the components are aromatic homologues, the Peng-Robinson equation of state is applied for thermodynamic property calculation.

Converge the flowsheet in Aspen plus for a fresh feed flow rate of 100 kmol/h containing $x_{C_6} = 0.3$, $x_{C_7} = 0.3$ and $x_{C_8} = 0.4$ with a benzene purity of 99.5 mol%, toluene purity of 99.5 mol%, and xylene purity of 99.9 mol%. The main operating conditions is shown in the figure.

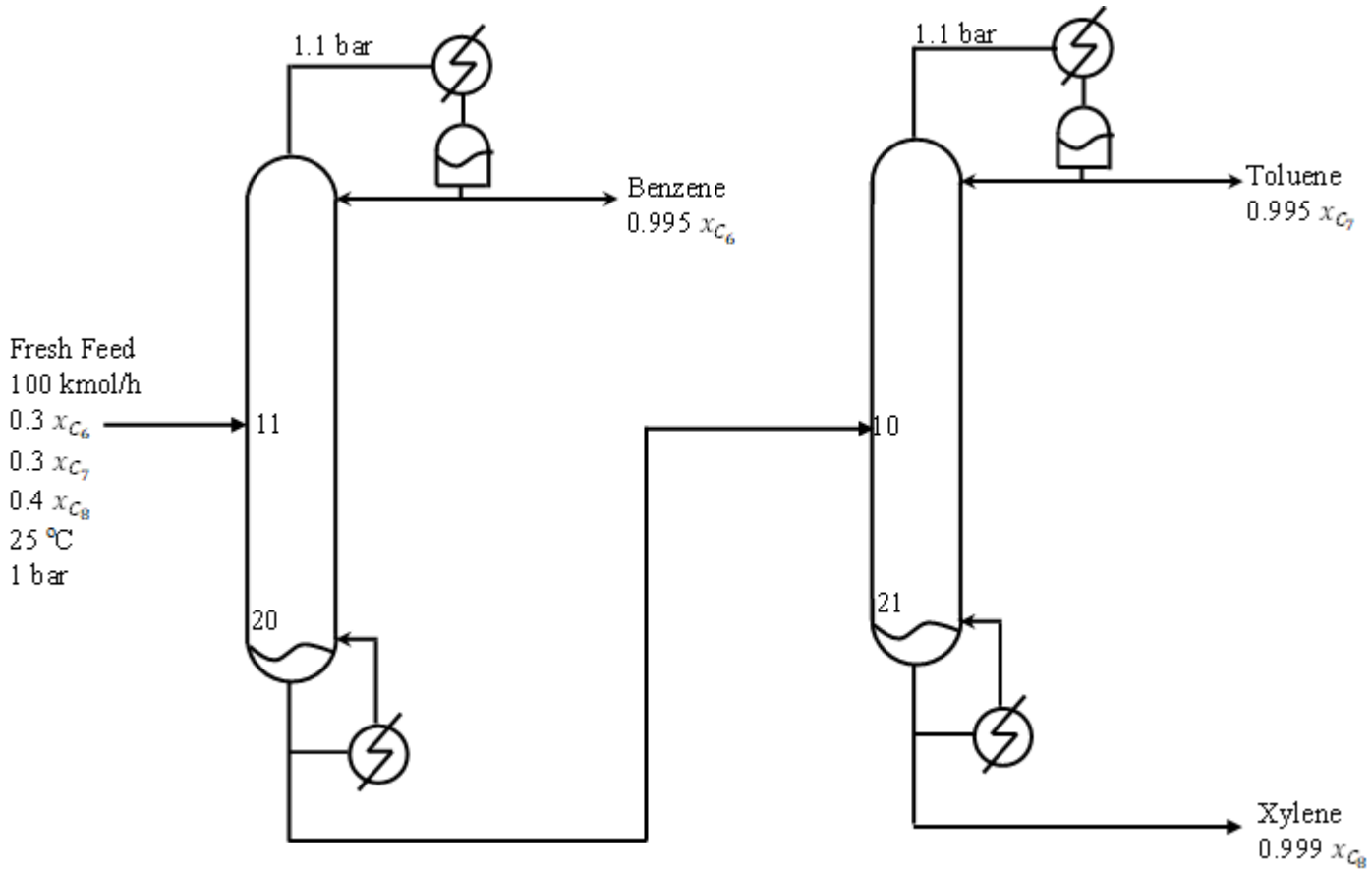

Figure 1: BTX separation process