1. Problem 4.1

Sources	Weight%	Flow (kg/s)	Load (kg/s)
Dryer	0.4	5.5	0.022
Coating	1.9	3.0	0.057

Sinks	Weight%	Flow (kg/s)	Load (kg/s)
Dryer	0.1	5.5	0.0055
Coating	0.2	3.0	0.006

Dryer source can be recycled back to the dryer inlet.

$$\text{Dryer recycle} = \frac{\text{Dryer load}}{\text{Dryer weight\%}} = \frac{0.0055}{0.4\%}$$
$$\text{Dryer recycle} = 1.375 \text{ kg/s}$$

There are still 4.125 kg/s available to recycle from the dryer.

$$\text{Coating recycle} = \frac{\text{Coating load}}{\text{Dryer weight\%}} = \frac{0.006}{0.4\%}$$
$$\text{Coating recycle} = 1.5 \text{ kg/s}$$

Maximum load has been achieved.

$$\text{Total recycle} = 2.875 \text{ kg/s}$$
$$\text{Fresh feed saved} = 8.5 - 2.875 = 5.625 \text{ kg/s}$$
$$\text{Discharge reduced} = 8.5 - 2.875 = 5.625 \text{ kg/s}$$

Redirecting 2.875 kg/s from the dryer effluent reduces the total necessary fresh feed to 5.625 kg/s and the total discharge to 5.625 kg/s.

2. Problem 4.2

Sources	Weight%	Flow (kg/h)	Load (kg/h)
Absorber I	5	5100	255
Acid Tower	10	10200	1020

Sinks	Weight%	Flow (kg/h)	Load (kg/h)
Absorber II	14	1400	196
Primary Tower	25	9100	2275

Plot sink and sources composite lines.

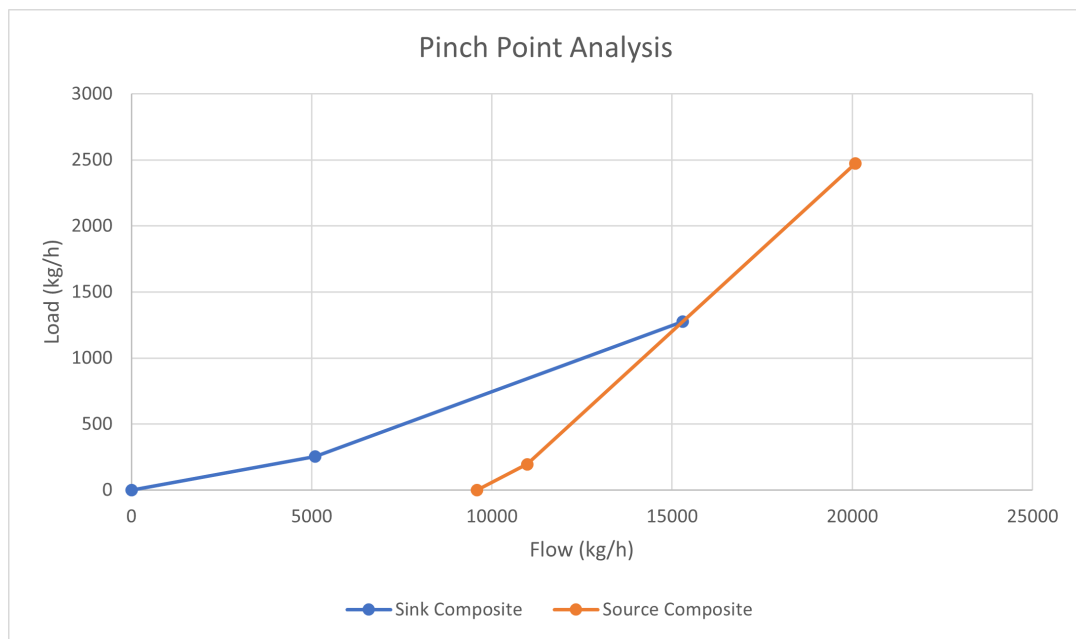Sink lines

$$\text{Load} = 0.05 \cdot \text{Flow, until 5100 kg/h}$$
$$\text{Load} = 0.1 \cdot (\text{Flow} - 5100) + 255, \text{ until 15300 kg/h}$$

Source lines; guess x-intercept

$$\text{Load} = 0.14 \cdot (\text{Flow} - \text{x-intercept}), \text{ until x-intercept} + 1400 \text{ kg/h}$$
$$\text{Load} = 0.25 \cdot (\text{Flow} - \text{x-intercept} - 1400)$$
$$+ 0.14 \cdot (x - intercept + 1400), \text{ until x-intercept} + 1400 \text{ kg/h}$$
$$, \text{ until x-intercept} + 10500 \text{ kg/h}$$

Plot the lines and vary the x-intercept until the sink and source lines intersect.

The pinch point came at an x-intercept of 9584. The target fresh acetic acid usage is 9584 kg/h and the target minimumm discharge is 4784 kg/h.