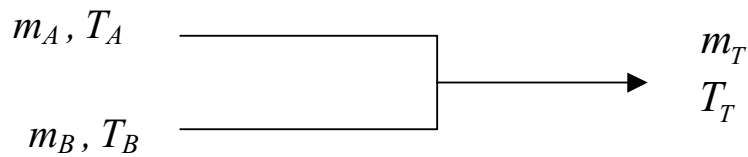


ChE 4400, Spring 2001
 Quiz #6
 Closed Book, Closed Notes
 Allowed Time: 15 minutes

Consider the following mixing streams:



Suppose that the steady state temperatures and mass flowrates are given as below:

$$\bar{m}_A = 10 \text{ kg / min}, \bar{m}_B = 1 \text{ kg / min}, \bar{T}_A = 50^\circ, \bar{T}_B = 100^\circ$$

Assume that both streams have the same heat capacity and the temperatures of the two inlet streams remain constant. Hence, the inputs are m_A and m_B and the outputs are m_T and T_T .

1. (2pts) Write down the steady-state mass and energy balances to express m_T and T_T in terms of the input variables.
2. (1pt) What are the steady state values of m_T and T_T ?
3. (2pts) Calculate the steady state gain matrix between the inputs and the outputs (a 2x2 matrix) by linearizing the steady-state balances at the given steady state condition.
4. (3pts) Calculate the RGA of the matrix.

Hint:
$$\lambda_{11} = \frac{1}{1 - \frac{k_{12}k_{21}}{k_{11}k_{22}}}$$

5. (2 pts) Propose appropriate pairing for multi-loop PID design based on the RGA.