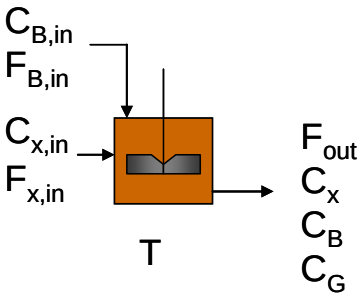
Chemical Engineering 436
Case Study

Please consider the following scenario as a group (2-3 per group):



A liquid effluent stream from your plant contains an environmentally undesirable component X. X is a regulated substance so that the maximum amount (lbs/year) that can be released into the environment has been determined by the EPA. The EPA has also set a maximum concentration for X in a liquid stream released into the environment. Both the flow rate of the effluent stream and the concentration of X in the stream vary with time. It is proposed that this stream be cleaned up by feeding it into a CSTR where it would be reacted with component B to form an environmentally friendly product G (for "green" of course) according to the following reaction:

$$X + B \rightarrow G$$

Component B, however, is extremely expensive.

Our control objective is to maintain the effluent concentration of X at a level (set point) which will satisfy the EPA requirements while using as little B as possible. Hence, the controlled variable is the concentration of X leaving the reactor. You are now requested to propose *alternatives* for controlled operation of the reactor.

The following questions may be useful as you address this problem.

a) How might feedback control be used to address this control problem? What would you measure? What options exist for the manipulated variable? What possible disturbance variables exist?

b) How might a feedforward control strategy be used? What would you measure? What options exist for the manipulated variable? What possible disturbance variables exist? What are the advantages and disadvantages of the feedforward strategy compared to the feedback strategy considered above?

c) How would you measure concentration? What potential problems, if any, does concentration measurement present?

d) Draw a schematic diagram for one of the feedback control systems specified above.

Show your work on the back side of this sheet. Each member of the group should sign below once they have completed the above task to their satisfaction. Turn in one copy.

_____ _____

_____