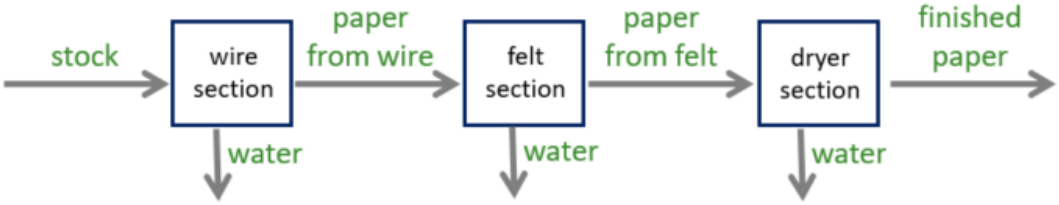
ENGR 121 Homework 15

NOTE: Use engineering format for problems 1 through 3, and use non-engineering format for problem 4. This is an individual assignment.

1. A recent LA Tech Mechanical Engineering graduate started working for a company that produces paper towels. The ME is the product line manager who over sees the paper towel making process. He is assessing the rate at which the paper (with various amounts of water) passes through the wire, felt, and dryer sections as well as the rate that water is removed from each of these sections. The table below provides information about the water and solid content for each section of the process

	Entering	Leaving
Wire Section	99% water, 1% solids	78% water, 22% solids
Felt Section	78% water, 22% solids	65% water, 35% solids
Dryer Section	65% water, 35% solids	4.5% water, 95.5% solids



If the rate that the paper leaves the dryer is 2000lb/min then, find the

a. Rate of paper leaving the felt; 5457.1lb/min
b. Rate of paper leaving wire; 8681.8lb/min
c. Rate of stock deposited onto the wire; 191000lb/min
d. Rate of water extracted from the dryer; 3457.1lb/min
e. Rate of water extracted from the felt; and 3224.7lb/min
f. Rate of water extracted from the wire. 182318.2lb/min

2. Using the information from question 1, analyze the overall system instead of the individual sections of the paper machine. Here, assume that you only know the composition of stock (99% water, 1% solids) and the composition of the finished paper (4.5% water and 95.5% solids). You will need to combine the wire, felt, and dryer sections into one system, grouping the water from each section into one water output quantity. Determine the rate that the stock enters the system and the overall rate that water is extracted from the system. Be sure to show your system diagram. stock enters = 191000lb/min & water extracted = 189000lb/min

3. Your fishtank which is 1.6 inches in diameter and 2 inches deep is upset with a sudden dose of salty water, raising the salinity in the fishtank to 0.28 wt% NaCl. You are interested in opening the DI solenoid valve to bring the concentration of the water closer to the setpoint of 0.11 wt% NaCl.
   (a) What is the target concentration if you have a gain of 0.70 (70%)? 0.161%
   (b) Using this gain, how much DI water (0% NaCl) should be added? 32.9g
   (c) How long should you leave the valve open if the flow rate is 0.1 L/min? 19.8s

Recommended assumptions:

- The water that leaves the overflow is a mixture of water from the salty tank and the fishtank.
- The saltiest the overflow water can be is 0.28 wt% NaCl, and the least salty it can be is 0% from the DI makeup water. Assume that 15% of the overflow water is DI water and that the rest is 0.28 wt% NaCl.
- Neglect density differences between incoming and outgoing water; that is, the mass of water that comes in from the salty tank is equal to the mass of water that leaves through the overflow.

4. Print out the final system evaluation form on the downloads page under Class 14. Fill out the first page of information for your fishtank system. Include deadtime compensation and gain.

5. (Due Class 18) Continue to work on fishtank systems with the intelligent control of salinity. Fishtank systems will be due on Class 18, but your instructor will be ready to evaluate them as early as Class 17. You will need to have temperature control as well as intelligent salinity control working for the evaluations. The evaluation sheets can be found under Class 14.

6. (Due Class 19) Group presentation for fishtank project:
    a. Time: Six minutes with 2 minutes for questions (8 minutes total)
    b. Participation: All team members must present
    c. Dress: Professional (business casual) attire
    d. Presentation should include
        i. Title slide with project title and the names of each team member
        ii. Project overview
        iii. Temperature control system
        iv. Salinity control system
        v. Overall system operation
        vi. Discussion of what worked well and what could be improved
        vii. Conclusions
    e. Consider including these topics in your presentation. You are not limited to these topics
        i. Overview of operation (pictures)
        ii. Description of system components (pictures, specifications, cost)
        iii. Circuit diagram and explanation (power supply, transistor, relay, interface to Arduino)
        iv. Calibration steps and equations for the conductivity sensor and thermistor
        v. Programming and control
        vi. Reliability issues