ENGR 121 Homework 6

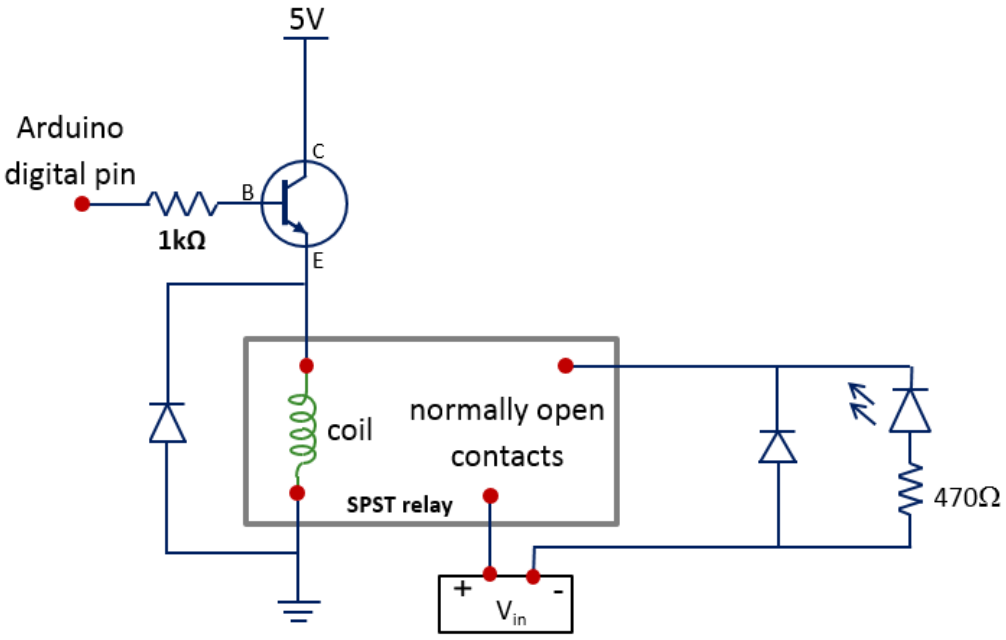
NOTE: Use engineering format for problems 1 through 2, and use non-engineering format for problem 3 through 6. This is an individual assignment.

1. You are preparing 227g of coffee which is 85°C. You prefer your coffee to be at 75°C. How much milk, which is at 4.5°C, would you have to add to reach your desired coffee temperature? $m_{milk} = 34.3g$
   Note: $C_{p_{coffee}} = 4184 \frac{J}{kg \cdot °C}$ and $C_{p_{milk}} = 3930 \frac{J}{kg \cdot °C}$

2. While camping, you decided to take a warm bath. You find a fresh pool of rainwater 0.5m deep x 0.3m wide x 1.6m long that has collected in a rocky cavity. The water temperature is 12°C and you would like to heat it up to 45°C. Your plan is to use your campfire to heat rocks to a temperature of 180°C and then roll the hot rocks into the water until the temperature is right. How many rocks will you need if the average mass of the rocks is 1.5kg and the average specific heat of the rocks is $800 \frac{J}{kg \cdot °C}$? Assume that the cavity that contains the water is insulated (no heat loss) and can hold as many rocks as needed without spilling over. 205 Rocks

   Note of Caution: Heating in the manner described above can be dangerous. Moisture in the rocks could make them explode, resulting in injury or death.

3. Take the relay circuit that you built in class off of your breadboard. Try to use the circuit diagram to rebuild the circuit on your breadboard. Instead of the motor use a resistor and LED. Note: you can take a picture of your relay circuit before you take it off your breadboard for reference, but try to use only the circuit diagram below.



4. Add a thermistor circuit to your breadboard with the cascading switch circuit (use an LED and resistor instead of the motor from class) from problem 4. Write a sketch that uses the output of the thermistor circuit with the setpoint at room temperature to make the LED turn on when the temperature is below the UCL and the LED turn off when the temperature is above the UCL.

   Include a screen shot of your sketch and your serial monitor output with your homework. Please bring your system to class ready to show your instructor. Please don't forget our programming habits:
   - Print out everything
   - Create a separate function for turning the LED on (this will be a very short function)
   - Create a separate function for turning the LED off (this will be a very short function)
   - Print out notifications when entering each function
   - Use proper data types

Extra Challenge: set a timer for the start of the sketch (overall time) and set a second timer that starts when the LED is off and another timer when the LED is on. The timer in each LED on/off function should start at zero each time the function is initiated.

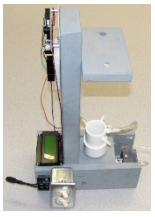
Note: **Have your circuit out on your table with the program running so that your instructor or class assistant can quickly check your work. Do not turn your homework in at the front; have it ready so that the instructor / assistant can grade this activity.**

5. Turn in your SolidWorks assembly of the wooden fishtank platform. Turn in two screen shots of your SolidWorks drawing(s), one at an intermediate stage (unassembled) and one of the final platform (fully assembled). Turn in your hand sketch with your SolidWorks drawings.

6. Turn in your SolidWorks drawing and hand sketch of the Sparkfun LCD screen. A rough depiction of the shape is acceptable, but use correct measurements. One should be included in your parts kit, but you can also refer to the Sparkfun website for more details on the LCD screen (https://www.sparkfun.com/products/9568). Turn in two screen shots of your SolidWorks drawing(s), one at an intermediate stage and one of the final stage.

7. (Due Class 9) The SolidWorks assignments that you have been working on will culminate in HW 8 by combining all the parts listed below into one assembly. Keep all SolidWorks drawings/assemblies of the individual components, and turn them in again with the final assembly. Show your final assembly from at least two points of view.

   Parts to be created:
   - the fishtank reservoir with three fittings (inlet, outlet, overflow)



- the conductivity sensor with fittings (you don't have to draw the wires, terminals or tubing)
- the wooden platform assembly
- the 3-way valve
- the LCD screen (rough detail of shape is good enough, but use correct measurements)
- the Arduino (rough detail of shape is good enough, but use correct measurements)
- the pump (it's OK to use your pump assembly from ENGR 120)