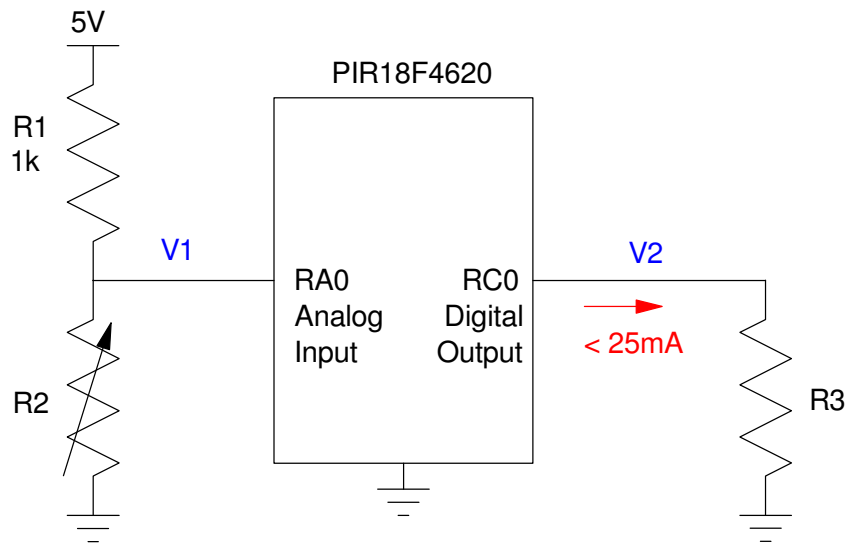


ECE 376 - Homework #1

PIC Background. Due Wednesday, January 18th

Please submit as a hard copy or submit on BlackBoard

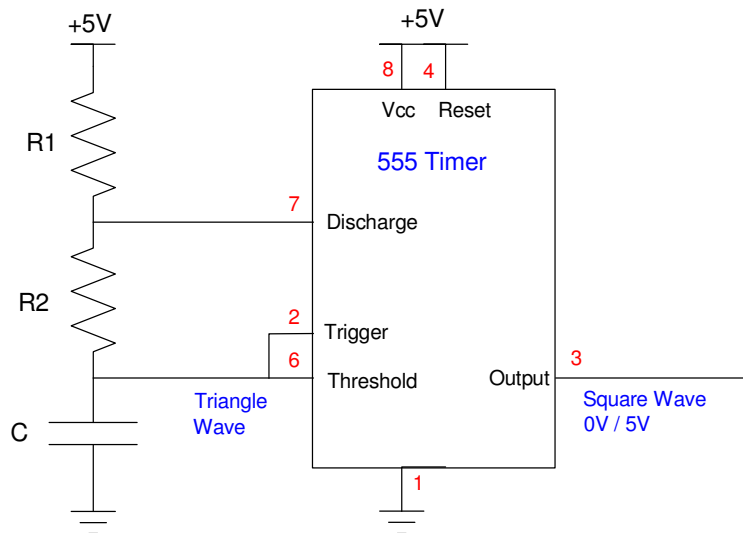
Problem	Answer
1) A PIC's output is limited to 25mA. Assuming V2 is 5V, what is the smallest resistance you can connect to the output? (how small can R3 be?)	
A PIC can measure voltage to 4.88mV. To give an idea of how small this is....	
2) What is the smallest change in R2 a PIC can measure if R2 = 800 Ohms nominally? How much does R2 have to change from 800 Ohms for V1 to change by 4.88mV?	
3) Assume R2 is a thermistor. - What temperature is it if R2 = 800 Ohms? - How much does the temperature have to change for V1 to change by 4.88mV?	
A PIC can measure time to 100ns. To give an idea of how small this is....	
4) The fastest hockey puck shot was 110.3 mph (46.98 m/s) by Denis Kulyash in 2011. If the puck travels 89 feet to the net (shot from mid-line), - How long does it take to travel to the net? - How much faster would the puck have to travel for it to take 100ns less to travel this distance?	
5) The world record for a 500m speed skate is 38.9 seconds (Hasse Borjes in 1970). How far behind would you have to be (in meters) if you cross the finish line 100ns behind Hasse Borjes?	
6) Assume for the 555 timer - R1 = 1k, R2 = 800, C = 0.22uF - What frequency does the 555 timer output on pin #3?	
7) What is the smallest change in frequency a PIC can detect? i.e. how much does the frequency have to change for the period to change by 100ns?	
8) With this circuit, you can build an Ohm-meter (replace R2 with the resistance to be measured.) Assume R2 = 800 Ohms (nominally). How much does R2 have to change for the period to change by 100ns? i.e. What is the resolution of this circuit when used as an Ohm-meter?	
9) Replace R2 with a thermistor. How much does the temperature have to change for the period to increase by 100ns? i.e. what is the resolution in degrees C?	



Problem #1 to #3

If R2 is a thermistor, assume

$$R_2 = 1000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right) \Omega$$



Astable 555 Timer: Problems 5-8

The square wave at the Output has a period of $T = (R_1 + 2R_2) \cdot C \cdot \ln(2)$ seconds