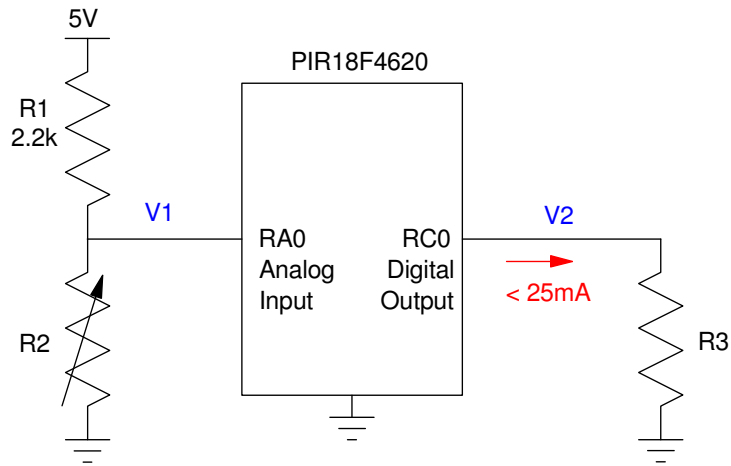


# ECE 376 - Homework #1

*PIC Background*

*Due Wednesday, January 22nd*

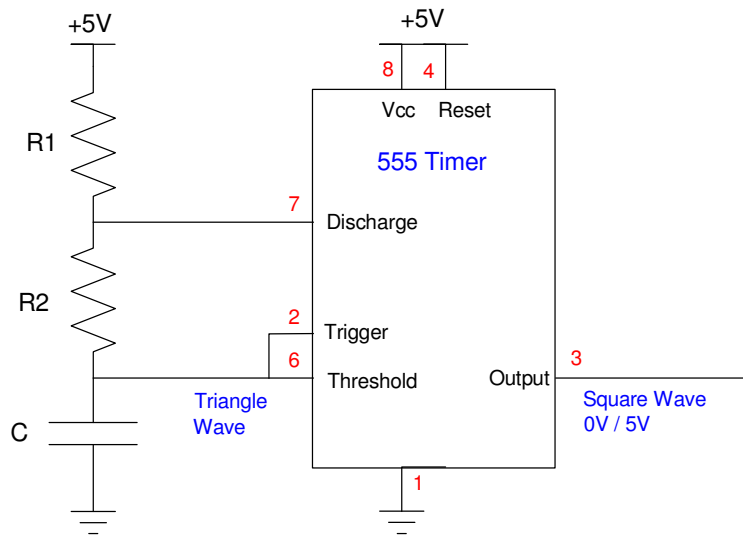
Problem	Answer
1) How many clocks does it take to do an integer operation in C? <ul style="list-style-type: none"> <li>• Check Homework #9 solutions for Spring 2024</li> </ul>	
2) A PIC's output is limited to 25mA. Assuming V2 is 5V, what is the smallest resistance you can connect to the output? (how small can R3 be?)	
<b>A PIC can measure voltage to 4.88mV. To give an idea of how small this is....</b>	
3) What is the smallest change in R2 a PIC can measure if R2 = 2.2k Ohms nominally? <ul style="list-style-type: none"> <li>• How much does R2 have to change from 2.2k Ohms for V1 to change by 4.88mV?</li> </ul>	
4) Assume R2 is a thermistor. <ul style="list-style-type: none"> <li>• What temperature is it if R2 = 2.2k Ohms?</li> <li>• How much does the temperature have to change for V1 to change by 4.88mV?</li> </ul>	
<b>A PIC can measure time to 100ns. To give an idea of how small this is....</b>	
5) The fastest X-man is Quicksilver - able to run 175mph. How far can Quicksilver run in 100ns?	
6) Assume for the 555 timer <ul style="list-style-type: none"> <li>• R1 = 2.2k, R2 = 2.2k, C = 0.22uF</li> <li>• What frequency does the 555 timer output on pin #3?</li> </ul>	
7) What is the smallest change in frequency a PIC can detect? <ul style="list-style-type: none"> <li>• i.e. how much does the frequency have to change for the period to change by 100ns?</li> </ul>	
8) With this circuit, you can build an Ohm-meter (replace R2 with the resistance to be measured.) Assume R2 = 2.2k Ohms (nominally). How much does R2 have to change for the period to change by 100ns? <ul style="list-style-type: none"> <li>• i.e. What is the resolution of this circuit when used as an Ohm-meter?</li> </ul>	
9) Replace R2 with a thermistor at a temperature where R2 is 2.2k Ohms nominally. How much does the temperature have to change for the period to increase by 100ns? <ul style="list-style-type: none"> <li>• i.e. what is the resolution in degrees C?</li> </ul>	



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