ECE 376 - Homework #1

PIC Background. Due Wednesday, September 3rd

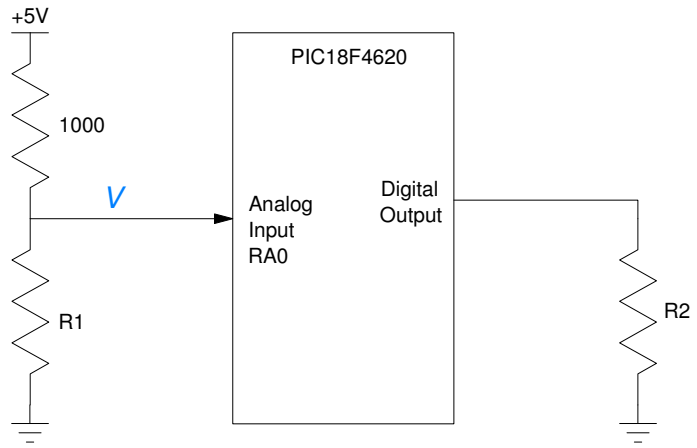
1) A PIC processor can drive up to 25mA on its I/O pins. Assuming the output is 5V, what is the smallest resistance you can connect to an output pin? • i.e. how small can R2 be (figure next page)	

A PIC can measure voltage to 4.88mV. To give an idea of how small this is....

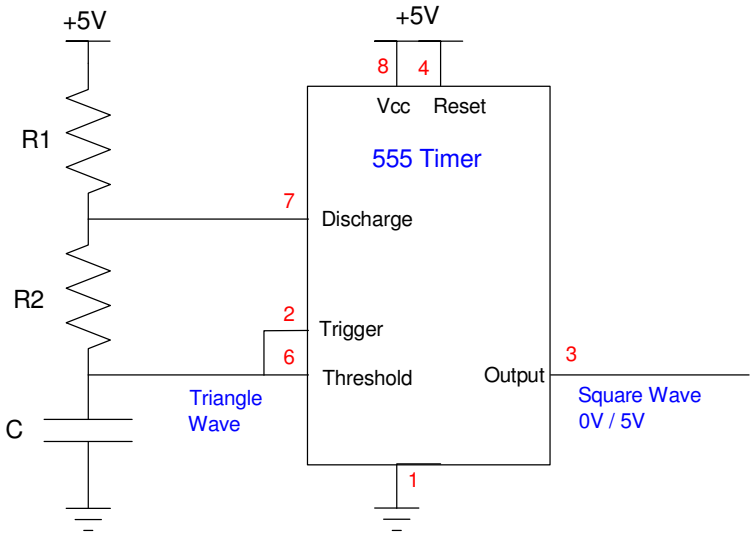
2) What is the smallest change in R1 a PIC can measure if R1 = 2000 Ohms nominally? $V = \left(\frac{R_1}{1000+R_1}\right) \cdot 5V$	

A PIC can measure time to 100ns. To give an idea of how small 100ns is...

3) The X-man *Quicksilver* can run 2050 miles per second. How far can *Quicksilver* go in 100ns?	
4) Due to relativity, time slows down the faster you go. How fast do you have to travel for time to slow down by 100ns over the span of one year?	
5) A 555 timer (next page) outputs a square wave with the period of T = (R1 + 2R2) * C * ln(2) seconds What frequency does the 555 timer output if R1 = 1k, R2 = 10k, C = 10uF?	
6) 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?	
7) With this circuit, you can build an ohm-meter: by mesuring the period, you can compute the resistance. • What is the smallest change in R2 a PIC can detect? • i.e. how much does R2 have to change for the period to change by 100ns?	
8) With this circuit, you can build a temperature sensor: by mesuring the period, you can compute the resistance and from that determine the temperature. • What is the smallest change in temperature a PIC can detect? • i.e. how much does R2 have to change for the period to change by 100ns? Assume the temperature - resistance relationship of R2 is as follows where T is the temperature in degrees C. Also assume the temperature is 25C (R2 = 10k Ohms) $R_2 = 10,000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right)\Omega$	



Problem #1 & #2



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