ECE 376 - Homework #1

PIC Background. Due Wednesday, January 19th

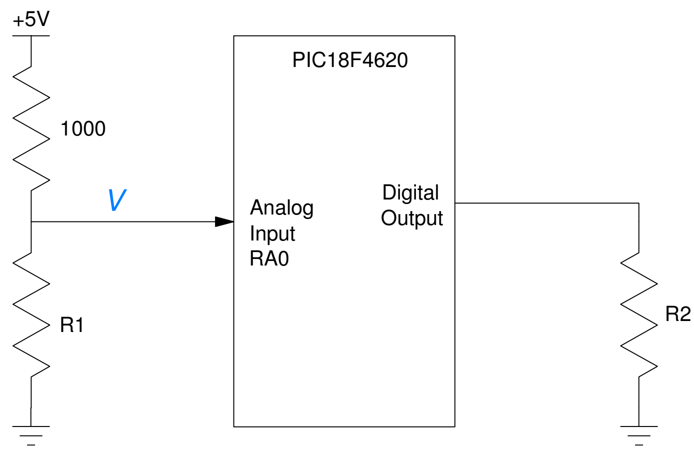
Please make the subject "ECE 376 HW#1" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

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)	

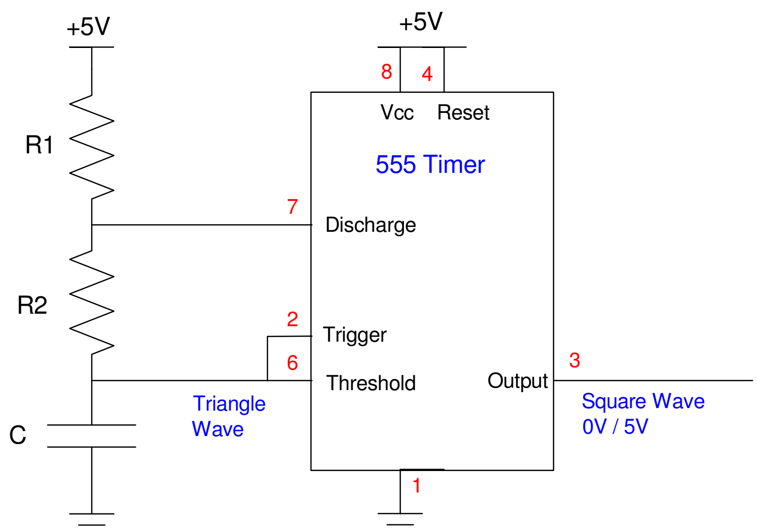
A PIC can measure voltage to 4.88mV. To give an idea of how small this is....

2) What is the smallest change in R1 a PIC can measure if R1 = 500 Ohms nominally? $V = \left(\frac{R_1}{1000+R_1}\right) \cdot 5V$	

3) The world record for the highest vertical leap is 65 inches. • How long are you in the air for a 65 inch vertical leap? • If you can measure time to 100ns, how precisely can you measure this distance? (i.e. how much higher do you have to jump for your air-time to be 100ns longer?	
4) The world record for a 100m dash is 9.58 seconds (Usain Bolt). How far behind would you have to be (in meters) if you cross the finish line 100ns behind Usain Bolt?	
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 = 0.1uF?	
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) $R_2 = 10000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right)\Omega$	



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