Analog meets Digital:
Two additional exercises (2009)

1. Potentiometer test (no response required in lab report)
   - 50k potentiometer for any value > 1k

   (a) use a multimeter to identify the fixed & wiper pins

   (The wiper pin moves as you turn the pot.)

   (b) Connect the potentiometer across the ±12V power supply on the prototyping board, and use a multimeter to observe how the DC output voltage varies as you change the wiper. (Be sure to allow enough time for the multimeter to reach measurement before moving the wiper again.)
2. Comparator

requires:

- LM311N comparator
- 4.7 k resistor or 5.1 k
- 100 k resistor
- potentiometer (50 k typical)

Overview:

(a) You will observe how a comparator will output a (relatively) clean digital
    output (+5V or 0V) depending on whether
    an input analog input voltage is > or <
    than a threshold voltage. You will establish
    the threshold voltage using a potentiometer.

(b) You will observe an undesired oscillation in
    the comparator's output, and you will
    eliminate this oscillation by adding positive feedback to
    the comparator.
(a) Comparator procedure:

connect the comparator chip to the:

+12 V power supply (for analog)
+5 V ... (for digital)

as shown below, using the function generator to provide the analog input waveform:

- Adjust the function gen to provide an output:
  - 8 V peak-peak sine wave, 1.5 kHz (digital)

- On the oscilloscope, observe the comparator output on CH1 and the sine wave analog input on CH2. Trigger the scope on CH1 using the falling edge.
  - Use 100 μs/division for the horizontal display.
part h)
(continued)

- Record the oscilloscope display when the threshold is set to the following two values: (i) +3V
  (ii) 0V

- Discuss, quantitatively, how the output digital waveform changes states in response to:
  - Upgoing analog input voltage
  - Downgoing

b) Now zoom in to the downgoing change in digital output voltage by using 250 nsec/div on the oscilloscope's horizontal display.

- Record an image of the "ringing" or "oscillations" present in the digital output (typical time scale a 250 nsec).

- Now connect a 100k ohm resistor between the output pin 7 and the non-inverting input pin 2 of the comparator. This provides positive feedback. Record the waveform. Discuss whether the undesired oscillations are diminished by using positive feedback.