Lab 7: Positive feedback and oscillators

Objectives:

- see how positive feedback can be used to make a trigger or oscillator
- use a special-purpose IC (a 555) to make a square wave generator

General notes:

- Remember that the DIP (dual in-line package) chips should straddle the trench in the breadboard
- Remember that we don't always show power to the chip on the circuit diagram, but it always needs to be there (usually ±15 V). Check your breadboard supplies and adjust them to be fairly close to ±15V.
- If you see "fuzz" on your output voltages, try putting a small ceramic capacitor (few tenths of a μF) between each of the power supplies and ground (to act as a short for very high frequencies; this will tend to eliminate the oscillations that cause the "fuzz").

7-3 555 timer in astable operation (square-wave generator)

Build the circuit shown in Fig. 9.6 in Kaplan and White. Make R_A and R_B both 10k, and make C=0.1 μF.

Look at V_{out} and at the voltage across the capacitor. Carefully sketch both on the same time scale, labeling voltages and times (duration that the output signal is high, and duration that it's low). What is the capacitor doing when the output is high? What is it doing when the output is low?

From the circuit's component values, predict the duty cycle of the output waveform and then measure it. Predict the frequency of the output waveform and then measure it.

What do you expect to happen to V_{out} and the voltage across the capacitor if R_2 is shorted out? Try it. Sketch or describe the results, and explain why they make sense. What's the duty cycle of this waveform? What's the frequency?

Change the power supply voltage to +10 V. Does that affect the amplitude of the square wave? Does it affect the frequency?

Use the output of the 555 to make an LED blink on and off (you'll need to change R and/or C values to make the blinking slow enough to see). Show me your design before actually turning it on.

Come up with a design that would allow a 50% duty cycle square wave to be output. Show me your design before actually turning it on. Sketch a schematic design of your circuit and describe or sketch the results, and comment on how well your design works and why.