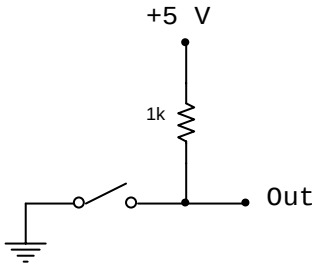
E100 Lab 7 – Logic Circuits II

I. Prelab

See separate pre-lab.

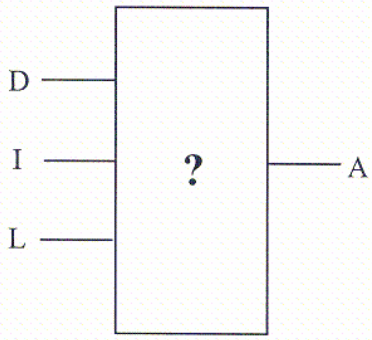
II. A Car Alarm



1. Connect three switches in a DIP switch package and three resistors as shown above. Measure the output of these circuits with your DMM, when each switch is open (or 'off') and when it is closed (or 'on'), to assure that the circuits are working correctly. These switch circuits will generate the input signals for other parts of the lab.

2. Construct the circuit for the car alarm that you designed in the prelab, using only NAND gates. Connect 3 switch circuits to the logic inputs D, L and I. Use the DMM to measure and record the logical output (A) for all possible inputs. For TTL gates, an input or output voltage is 'high' or '1' if the voltage is greater than 2.0V. An input or output voltage is 'low' or '0' if the voltage is less than 0.8V. Record the results in a truth table. Is it the same as the desired the truth table?

Inputs			Output
D	I	L	A
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1



III. Counter

1. Use the function generator to create a 5V square wave to use as a clock. Measure the clock using the scope. The clock signal should go from 0V to 5V. Set the clock frequency to 10kHz.

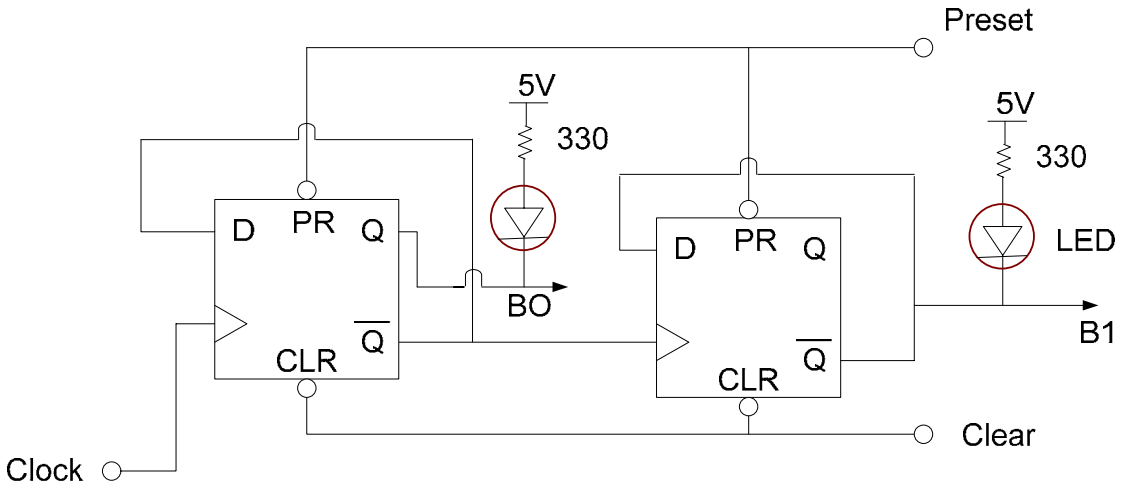
2. Build the 2-bit counter below using the two D flip-flops in a 7474 (or 74LS74) integrated circuit. However, you don't need to include the LEDs and 330 ohm resistors yet. Connect the square wave from the function generator to the clock input on the first D flip-flop, and connect a 5V power supply to the integrated circuit.

3. The flip-flops have Preset and Clear inputs, both of which are active low signals. So these inputs affect the flip-flop outputs only when they are low. Initially, make Preset = 0 (connect Preset to ground) and Clear = 1 (connect Clear to 5 V). What are the output values of the Q outputs of the flip-flops? (Use the scope and DMM.)

4. Now, make Preset = 1 (connect Preset to 5 V) and Clear = 0 (connect Clear to ground). What are the output values of the Q outputs of the flip-flops? (Use the scope and DMM.)

5. Next, make Preset = 1 (connect Preset to 5V) and Clear = 1 (connect Clear to 5V). This will allow the two flip-flop outputs to change depending upon the D input value, and the complete circuit to operate as a counter. Take the counter outputs to be the outputs labeled B0 (the LSB) and B1 (the MSB). Using the scope, observe and draw the waveforms for Clock, B1 and B0 versus time. Since you can only look at 2 waveforms at a time, first look at Clock and B1, while triggering on B1. Then look at B0 and B1, while triggering on B1. If you consider B1 B0 as a 2-bit binary number, what is the sequence of numbers output by the counter?

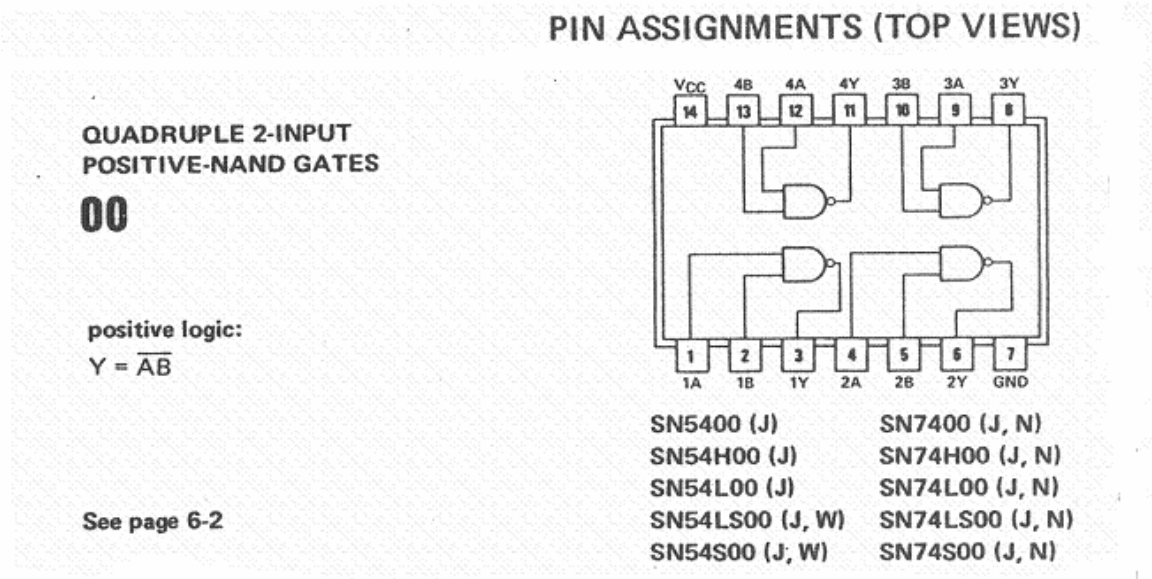
6. Connect the two LEDs as shown. **Each LED will light up when the signal to which it connects goes low.** Each LED will be off when the signal to which it connects goes high. Slow the Clock down to a very low frequency (say, 1 Hz). You should now be able to see the LEDs change as the counter outputs change.



IV. Lab Report

1. Turn in your prelab.
2. Turn in your measured truth table for the Car Alarm, and your data, plots and answers to questions for the counter circuit.

7400 and 74LS00 pin information:



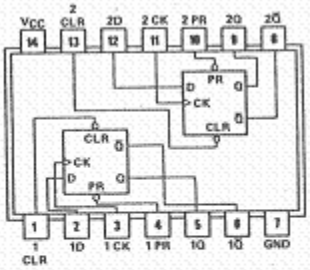
7474 and 74LS74 pin information:

DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR

74

FUNCTION TABLE

INPUTS				OUTPUTS	
PRESET	CLEAR	CLOCK	D	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\bar{Q}_0$



SN5474 (J) SN7474 (J, N)
SN54H74 (J) SN74H74 (J, N)
SN54L74 (J) SN74L74 (J, N)
SN54LS74A (J, W) SN74LS74A (J, N)
SN54S74 (J, W) SN74S74 (J, N)

See pages 6-46, 6-50, 6-54, and 6-56

Updated: 5/18/07