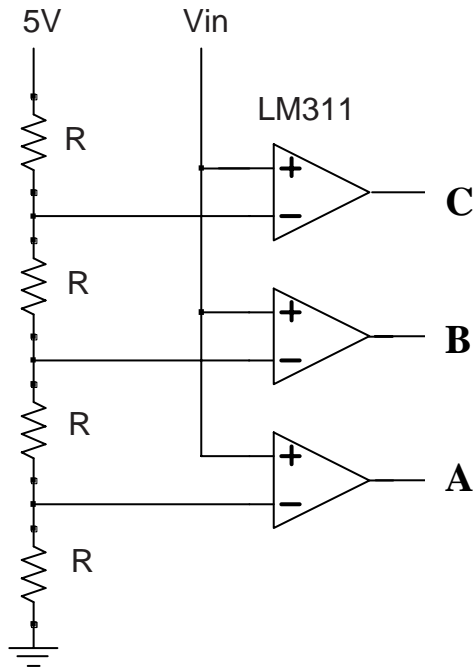


Physics 517/617 Experiment 6A Digital Circuits

Basic Experiment - Physics 517/617

Almost all the circuits in this part of the course will be built using the "DIGI DESIGNER" and tested using a logic probe. You should become familiar with both of these tools before you start the lab.

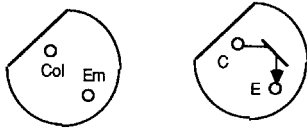
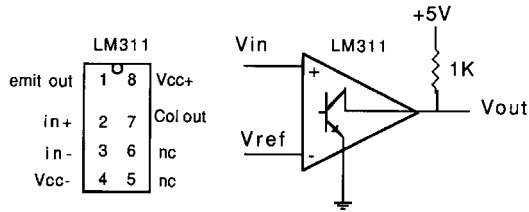
- 1) Verify the truth table for a NAND Gate (7400 chip), NOR Gate (7402), AND (7408), OR Gate (7432), and Exclusive OR Gate (7486). Use the lamp switches on the DIGI designer to signal a high or low state. What is the output voltage of a high or low state?
- 2) Verify the truth table for the JK flipflop (74S112) including reset and clear options.
- 3) Using 3 J-K flipflops build a circuit that counts from zero to seven, i.e. 0, 1, 2, 3, 4, 5, 6, 7, 0, ... Using the oscilloscope measure the maximum speed the counter can reliably work at.
- 4) The following is a design for a Flash ADC. For what ranges of V_{in} will A, B, and C be high and low. Design logic so the flash ADC will output the value V_{in} as a 2-bit digital number ($5V/4bit*(2^1*D1+2^0*D0)$).



Voltage	D1	D0
$V_{in} > 3.57$	1	1
$2.5 < V_{in} < 3.75$	1	0
$1.25 < V_{in} < 2.5$	0	1
$V_{in} < 1.25$	0	0

- 5) **Build the circuit** above to output A, B, and C. You don't need to add the logic of part 4.

Note: A comparator converts an analog voltage into a digital pulse. For a comparator use LM311's. If the positive (+) terminal of the LM311 is at a higher voltage than the negative (-) terminal you get 5 volts output. Otherwise you get zero volts output. The 1K Ohm resistor is called a "pull up" resistor.



Infrared Photodiode