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 $(5V/4bit*(2^1*D1+2^0*D0))$.

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 a 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.