Physics 623
Digital Circuits - PreLab Worksheet

Please complete before coming to the lab

Nov. 1, 2015

1) In section 2 we are going to construct a 4-bit counter using JK flip-flops. Explain clearly why the circuit of section 2 constitutes a 4-bit counter. What should J & K inputs be? What should the "set" and "reset" inputs be?

2) In section 3 we are going to construct a ring oscillator using NAND gates. Explain clearly why the circuit of section 3 constitutes an oscillator. Why do we need to use an odd number of gates? Where must the unused input of each NAND gate be connected? Assuming that each gate introduces a time delay, t_D, what is the frequency of the oscillation?

3) Constructing a pulse generator circuit using the two monostable multivibrators ("one-shots") in a 74LS221: We are not actually going to do section 4 of the lab (in order to shorten it and because monostables are seldom used any more). However, they are sometimes still useful to provide a simple way to generate a pulse of arbitrary (and approximate) length. So explain what this circuit in the lab does. Read the datasheet on the 74LS221 and determine what capacitor and resistor values, R_1, C_1, R_2, C_2 can you use such that the circuit will generate two pulses with the first pulse having a width of 1 ms and the second 0.3 ms.