

Physics 623

Digital Circuits - PreLab Worksheet

Please complete before coming to the lab

Nov. 7, 2012

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 monostable vibrator using 74LS221: We are not actually going to do this section 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 please 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 pulse-widths of 1 ms and 0.3 ms respectively?