Digital Design Preliminary Exam (Spring 2014)

Problem 1  20 points
Problem 2  20 points
Problem 3  20 points
Problem 4  20 points
Problem 5  20 points

Total  100 points

Name or Student ID:

Date: 3/21/2014
Problem 1

For the circuit of a 4-bit binary counter below, give two alternatives for a BCD counter:

1. Using load input.
2. Using the asynchronous clear input.

Draw the circuit for each design with all the necessary connections marked clearly based on Fig. 1 (a). The 4-bit “Data_in” and “A_count” can be split to each bit if necessary to show different connection. Fig. 1 (b) is provided for you to better understand the counter, you don’t have to draw the inside circuit of the counter.

Fig. 1 4-bit binary counter with parallel load
Problem 2
Use a 4-to-1 multiplexer to design a majority function (three inputs, one output goes with majority value of the inputs). Show truth table and circuit.
Problem 3
Design a counter that counts pulses on line \( w \) and displays the count in the sequence 0, 2, 1, 3, 0, 2, 1, 3, .... Use D flip-flops and other necessary logic gates in your circuit.
Problem 4

Draw a PLA circuit to implement the functions

\[ F_1 = A'B + AC + AB'C' \]
\[ F_2 = (AB' + A'C)' \]
Problem 5

Convert between different number systems.

a. Convert a decimal number 87 to binary.

b. Convert binary number 1100.101 to decimal.

c. Use 4 bits to represent decimal number – 4 in 2’s complement.