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.

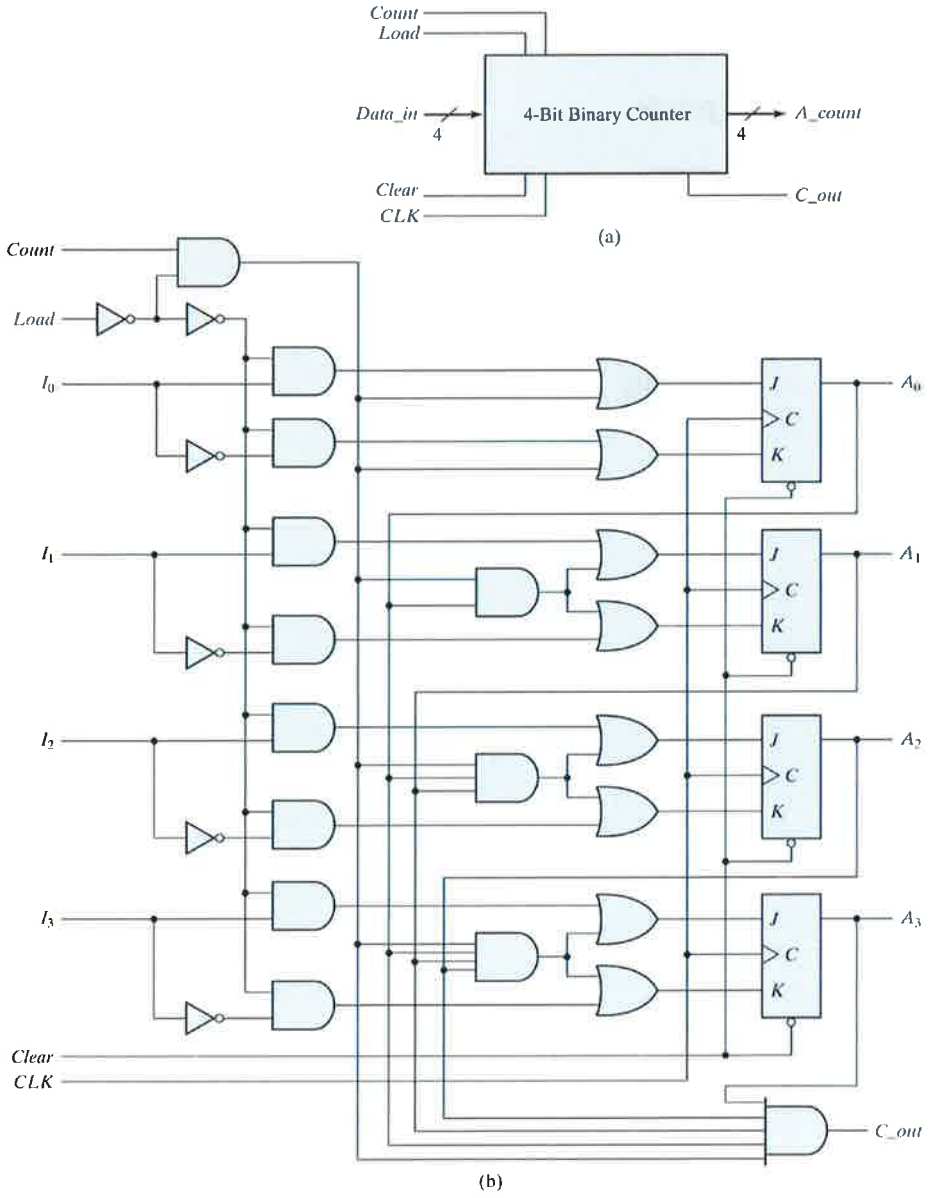

Fig. 1 4-bit binary counter with parallel load

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.