JOINT INSTITUTE
交大密西根学院

Ve270 Introduction to Logic Design

Homework 1

Assigned: May 14, 2020

Due: May 21, 2020, 2:00pm.

A pop quiz will be given on the due date.

1. Fill out the blank spaces, assuming unsigned numbers. Show steps to earn partial credits. (8 points)

   11011101.001_{2} = _____$_{10}$ = _____$_{16}$

   63.89_{10} = _____$_{2}$ = _____$_{8}$ = _____$_{3}$

2. Fill out the blank spaces, assuming 2's complement numbers. (16 points)

   -71_{10} = _____$_{2}$ = _____$_{16}$

   71_{10} = _____$_{2}$ = _____$_{16}$

   10110101101_{2} = _____$_{10}$

   $FBA9_{16}$= _____$_{2}$ = _____$_{10}$

3. Perform the following arithmetic operations step by step, assuming 2's complement numbers: (12 points)

   $(6FA49D + 73BD)_{16}$ =

   $(10100 - 10101001)_{2}$ =

   $(534 - 265)_{8}$ =

4. Problem 2.14 (Boolean equation = logic equation) (4 points)

2.14 Evaluate the Boolean equation `F = a AND (b OR (c AND d))` for the given values of variables `a`, `b`, `c`, and `d`:

   a. `a=1, b=1, c=0, d=1`
   b. `a=0, b=0, c=0, d=1`
   c. `a=1, b=0, c=0, d=0`
   d. `a=1, b=0, c=1, d=1`

5. Problem 2.16 (10 points)

2.16 Show the conduction paths and output value of the AND gate transistor circuit in Figure 2.14 when: (a) `x = 1` and `y = 0`, (b) `x = 1` and `y = 1`.

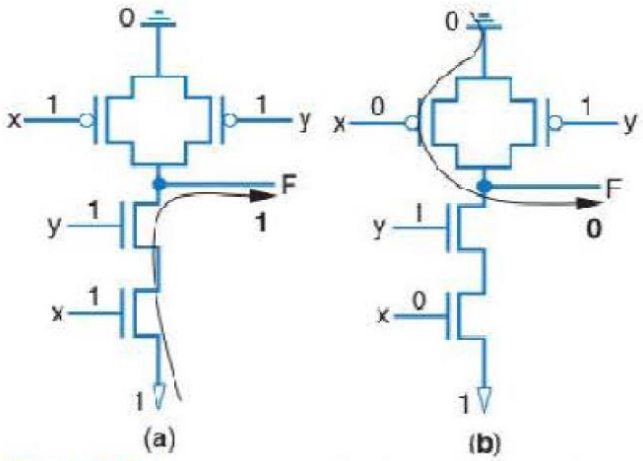


Figure 2.14 AND gate conduction paths: (a) when all inputs are 1, and (b) when any input is 0.

6. Problem 2.19 (10 points)

2.19 Convert each of the following equations directly to gate-level circuits:

a. F = abc + a′bc

b. F = a + bcd′ + ae + f′

c. F = (a + b) + (c′ * (d + e + fg))

7. Problem 2.20 (10 points)

2.20 Design a system that sounds a buzzer inside a home whenever motion outside is detected at night. Assume a motion sensor has an output M that indicates whether motion is detected (M=1 means motion detected) and a light sensor with output L that indicates if light is detected (L=1 means light is detected). The buzzer inside the home has a single input B that when 1 sounds the buzzer. Capture the desired system behavior using an equation, and then convert the equation to a circuit using AND, OR, and NOT gates.

8. Problem 2.35 (10 points)

2.35 Convert each of the following Boolean equations to a truth table:

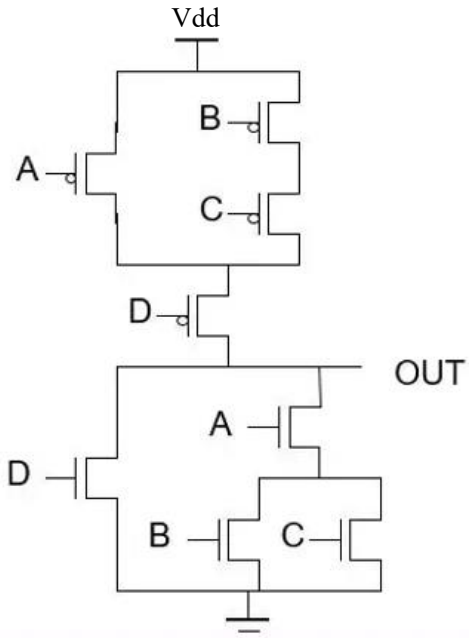
a. F(a,b,c) = a′ + bc′

b. F(a,b,c) = (ab)′ + ac′ + bc

c. F(a,b,c) = ab + ac + ab′c′ + c′

d. F(a,b,c,d) = a′bc + d′

9. Build a truth table for the following circuit. (10 points)



10. Given a logic equation F = a'bc' + b'c + abc, draw an output waveform for F based on the given input waveforms. (10 points)