



Ve270 Introduction to Logic Design

Homework 1

Assigned: September 17, 2019

Due: September 24, 2019, 4:00pm.

The homework should be submitted in hard copies.

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

$$10110101.101_2 = \underline{\hspace{2cm}}_{10} = \underline{\hspace{2cm}}_{16}$$

$$75.26_{10} = \underline{\hspace{2cm}}_2 = \underline{\hspace{2cm}}_8 = \underline{\hspace{2cm}}_3$$

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

$$-59_{10} = \underline{\hspace{2cm}}_2 = \underline{\hspace{2cm}}_{16}$$

$$59_{10} = \underline{\hspace{2cm}}_2 = \underline{\hspace{2cm}}_{16}$$

$$10010110101_2 = \underline{\hspace{2cm}}_{10}$$

$$F3A8_{16} = \underline{\hspace{2cm}}_2 = \underline{\hspace{2cm}}_{10}$$

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 $F = a \text{ AND } (b \text{ OR } (c \text{ AND } d))$ 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 2.15 (10 points)

2.15 Show the conduction paths and output value of the OR gate transistor circuit in Figure 2.12 when: (a) $x = 1$ and $y = 0$, (b) $x = 1$ and $y = 1$.

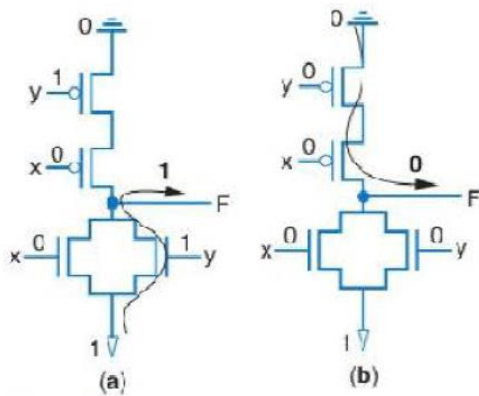


Figure 2.12 OR gate conduction paths: (a) when one input is 1, and (b) when both inputs are 0.

6. Problem 2.17 (c) (10 points)

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

(a) $F = ab' + bc + c'$

(b) $F = ab + b'c'd'$

(c) $F = ((a + b') * (c' + d)) + (c + d + e')$

7. Problem 2.21 (10 points)

2.21 A DJ (“disc jockey,” meaning someone who plays music at a party) would like a system to automatically control a strobe light and disco ball in a dance hall depending on whether music is playing and people are dancing. A sound sensor has output S that when 1 indicates that music is playing, and a motion sensor has output M that when 1 indicates that people are dancing. The strobe light has an input L that when 1 turns the light on, and the disco ball has an input B that when 1 turns the ball on. The DJ wants the disco ball to turn on only when music is playing and nobody is dancing, and wants the strobe light to turn on only when music is playing and people are dancing. Create equations describing the desired behavior for B and for L, and then convert each to a circuit using AND, OR, and NOT gates,

8. Problem 2.34 (a) (c) (10 points)

2.34 Convert each of the Boolean equations in Exercise 2.31 to a truth table.

2.31 Convert the following Boolean equations to a digital circuit:

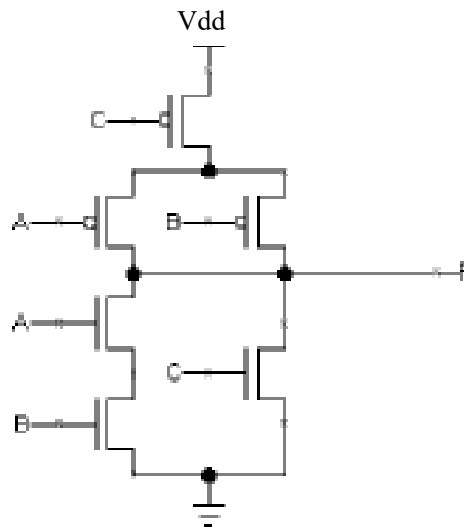
(a) $F(a, b, c) = a'bc + ab$

(b) $F(a, b, c) = a'b$

(c) $F(a, b, c) = abc + ab + a + b + c$

(d) $F(a, b, c) = c'$

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



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

