

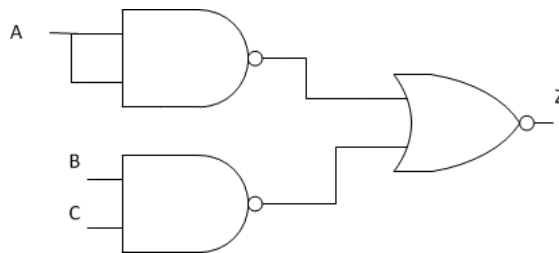
Homework 3 CS/ECE 252: Sec 1 & 2 [Due at lecture on Fri, Feb 21]

Primary contact for this hw: Muralidharan Sivalingam [murali10 at cs dot wisc dot edu]

**Instructions:** You must do this homework alone. Please hand in ONE copy of the homework listing your section number, full name (as appear in Learn@UW) and UW ID. You must staple all pages of your homework together to receive full credit.

**Problem 1 (6 points)**

For the following circuit ,



(a) (2 Points) Give the equation for output Z in terms of inputs A, B and C.

$$Z = \text{NOT}(\text{NOT}(A) + \text{NOT}(B \text{ AND } C)) = A \text{ AND } B \text{ AND } C$$

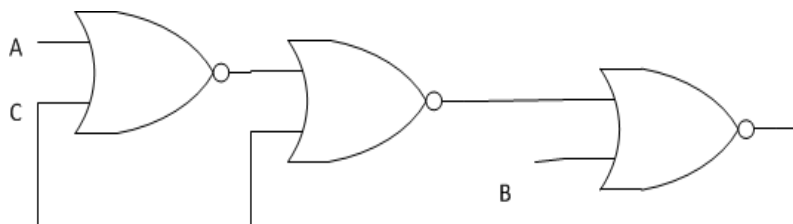
a) (4 points) Fill out the truth table for Z.

A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

**Problem 2 (2 points)**

Given the logic equation  $Z = \text{NOT}(B) \text{ AND } ((\text{NOT}(A) \text{ AND } \text{NOT}(C)) \text{ OR } C)$

Draw the gate-level circuit for Z using only 2-input NOR gates (Hint: DeMorgan's Law).



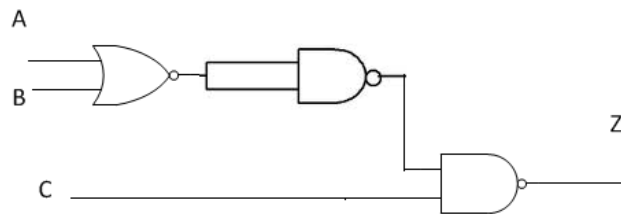
### Problem 3 (9 points)

Given the logic equation  $Z = \text{NOT}(A \text{ OR } B) \text{ OR NOT}(C)$

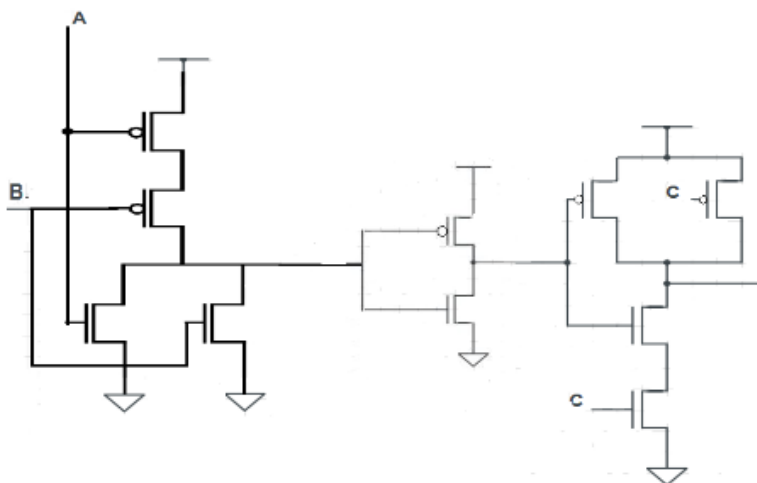
a) (4 points) Fill out the truth table for Z.

A	B	C	Z
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

b) (3 points) Draw the gate-level circuit for Z using only 2-input NAND or NOR gates (Hint: DeMorgan's Law).

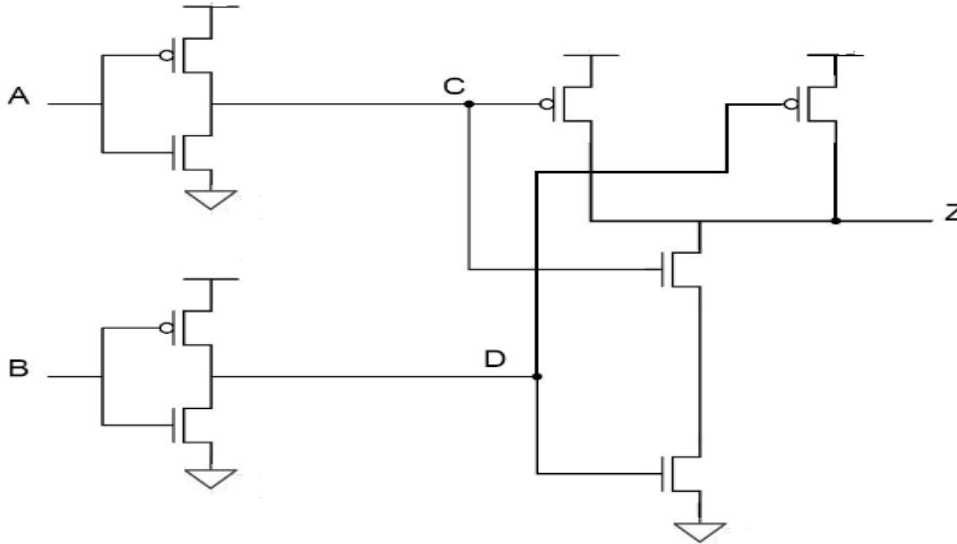


c) (2 points) Draw the transistor-level equivalent of the circuit



**Problem 4 (6 points)**

Given the following transistor level circuit :



a) (4 points ) Fill out the truth table for Z

A	B	C	D	Z
0	0	1	1	0
0	1	1	0	1
1	0	0	1	1
1	1	0	0	1

b) (2 points) Give the equation for Z in terms of A and B

$$Z = A \text{ OR } B$$

**Problem 5 (5 points)**

Imagine a logic circuit that performs the following function. It has three inputs A, B, and C. The output Z is 1 only if C = 0 and one among A and B is 0 (not both).

a. (3 points) Fill out the truth table for Z

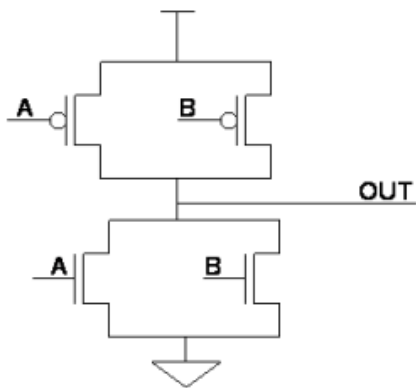
A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

b. (2 points) Write the logic expression for Z in terms of A, B and C.

$$Z = \text{NOT}(C) \text{ AND } ((A \text{ AND NOT } (B) ) \text{ OR } (B \text{ AND NOT}(A)))$$

**Problem 6 (2 points)**

The circuit below has a major flaw. Can you identify it? (Hint: Evaluate the circuit for all sets of inputs)



There is short circuit (path from Power to Ground) when either A = 1 and B = 0 or A = 0 and B = 1.