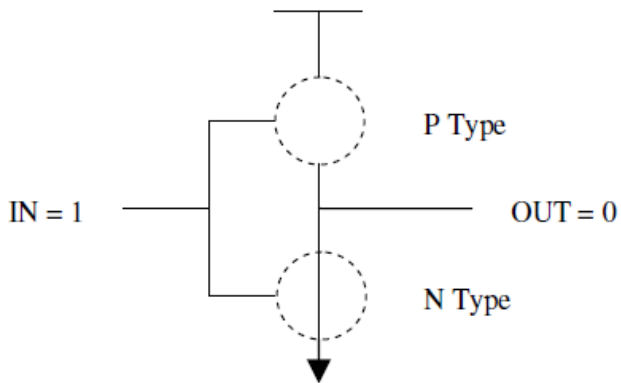### 3.1 – 5 points

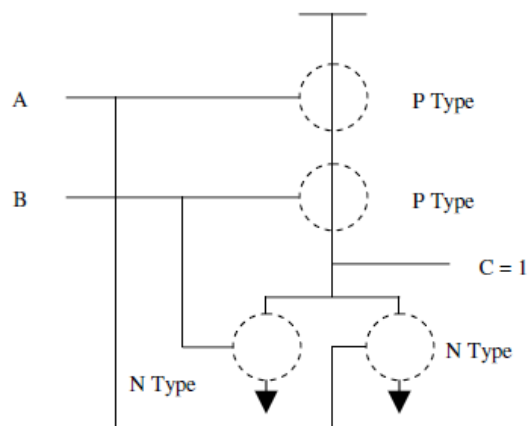|	N-Type	P-Type
Gate=1	closed	open
Gate=0	open	closed

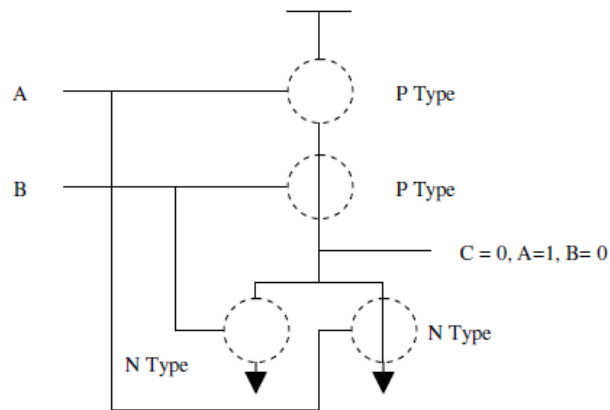Rubric: -1.25 for each wrong cell

3.2 – 5 points

Rubric: -2.5 for each wrong gate

3.4 – 10 points

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

Rubric: Had to draw one transistor with output 0 and one with output 1. 5 points for each

3.5 – 10 points

A	B	C		OUT
0	0	0		1
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

Rubric: -1.25 for each wrong row

3.6 – 10 points

$$C = A'; D = B'; Z = (C+D)' = (A'+B')' = A . B$$

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

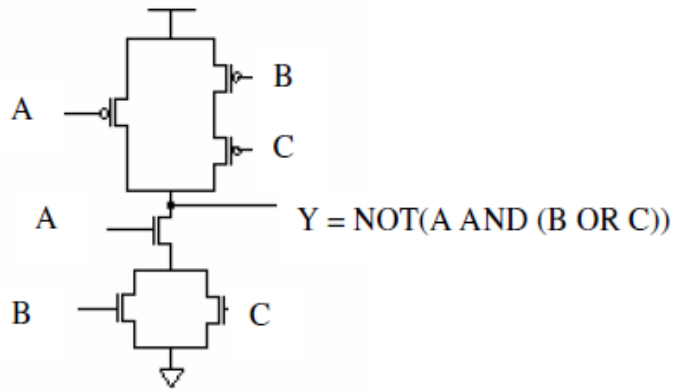Rubric: 5 points for truth table, 5 points for correct Boolean expression A AND B

3.7 – 10 Points
There is a short circuit when either A = 1 and B = 0 or A = 0 and B = 1.
Rubric: 5 for specifying the right problem, 2.5 for giving each pair of inputs that fail

3.8 – 10 points

Y = NOT (A AND (B OR C))
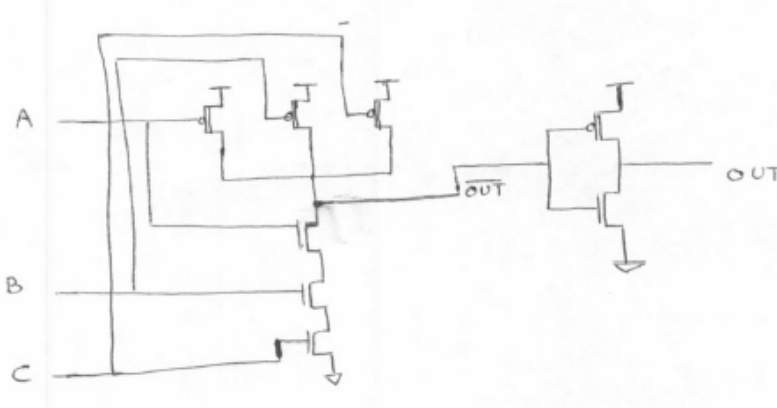

Y = NOT(A AND (B OR C))

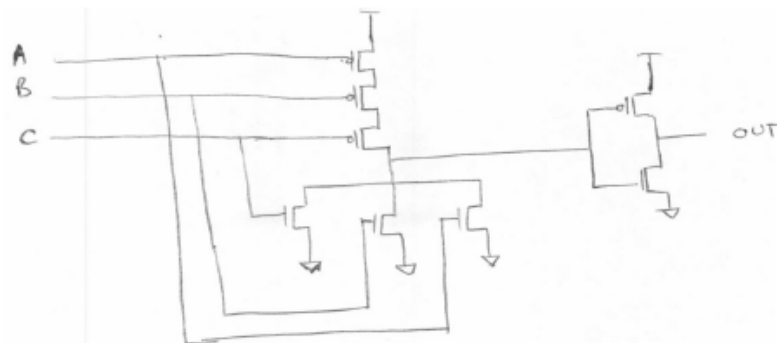Rubric: -1.5 for each incorrect label

3.11 – 25 points

(a) Three Input AND Gate – **10 points**
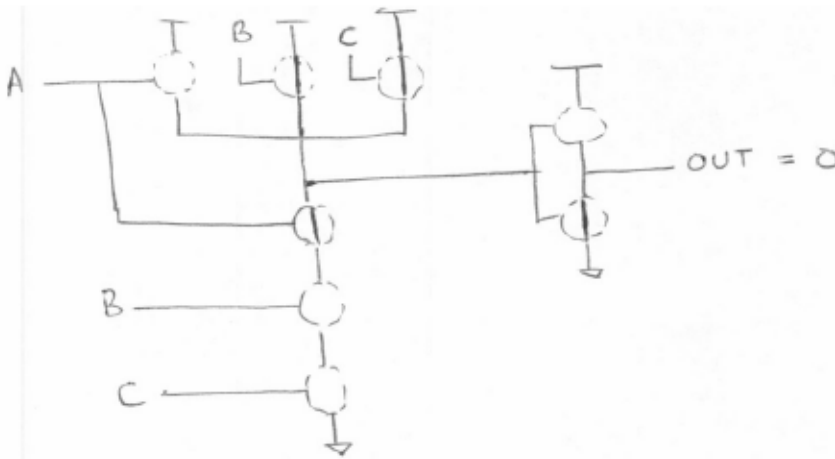**Rubric: 5 for each correct gate**
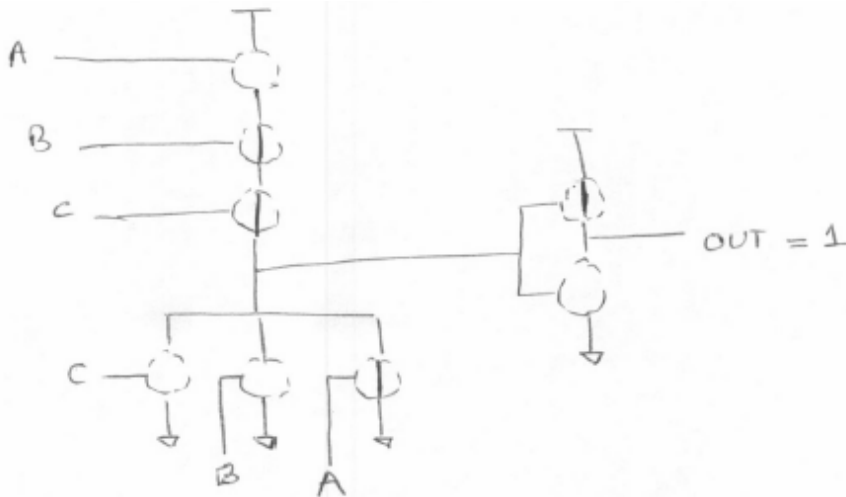

Three Input OR Gate

Rubric: 15 points, 5 for each group of inputs (2.5 for AND, 2.5 for OR). The student doesn't necessary have to draw all the cases separately, but it must somehow have showed the resulting transistor with the three given inputs
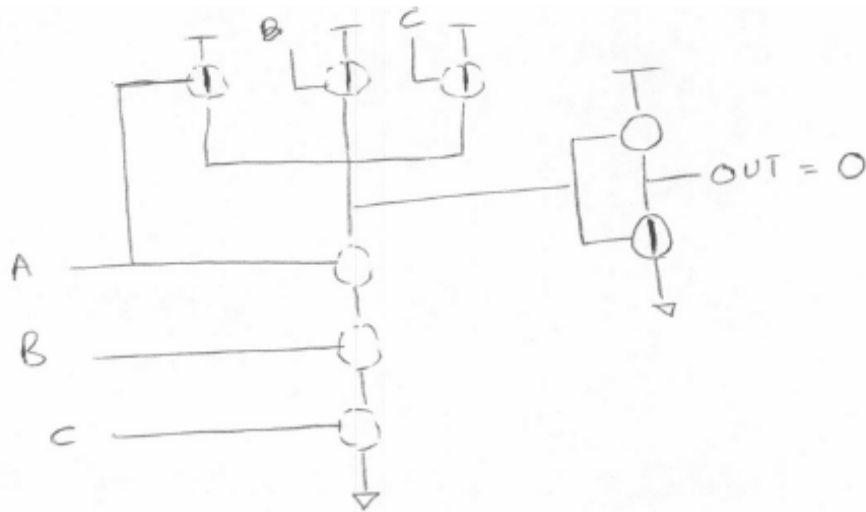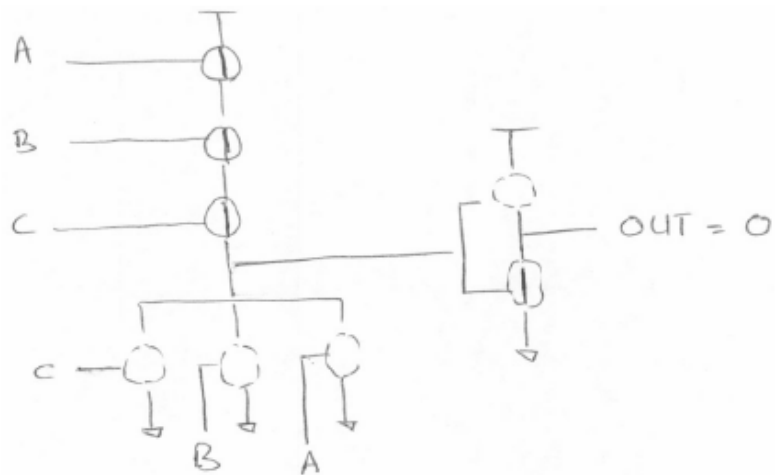
(b) (1) A = 1, B = 0, C = 0.
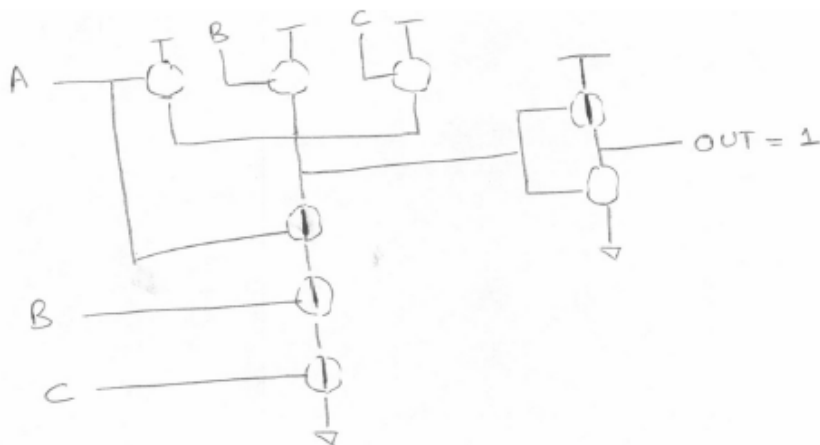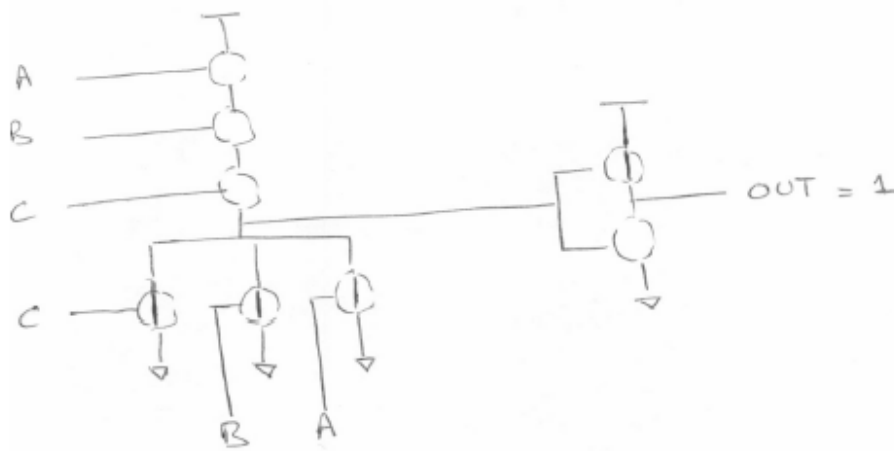AND Gate

OR Gate

0
(2) A = 0, B = 0, C = 0
AND Gate

OR Gate

(3) A = 1, B = 1, C = 1
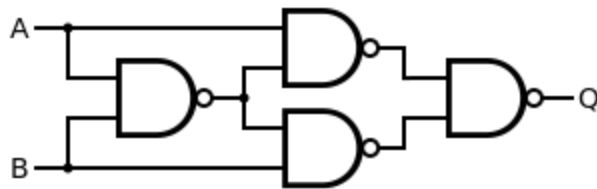AND Gate

OR Gate

OUT = 1

Custom Problem 1: 15 points

(a) Truth table for 2-input XOR gate – **5 points**

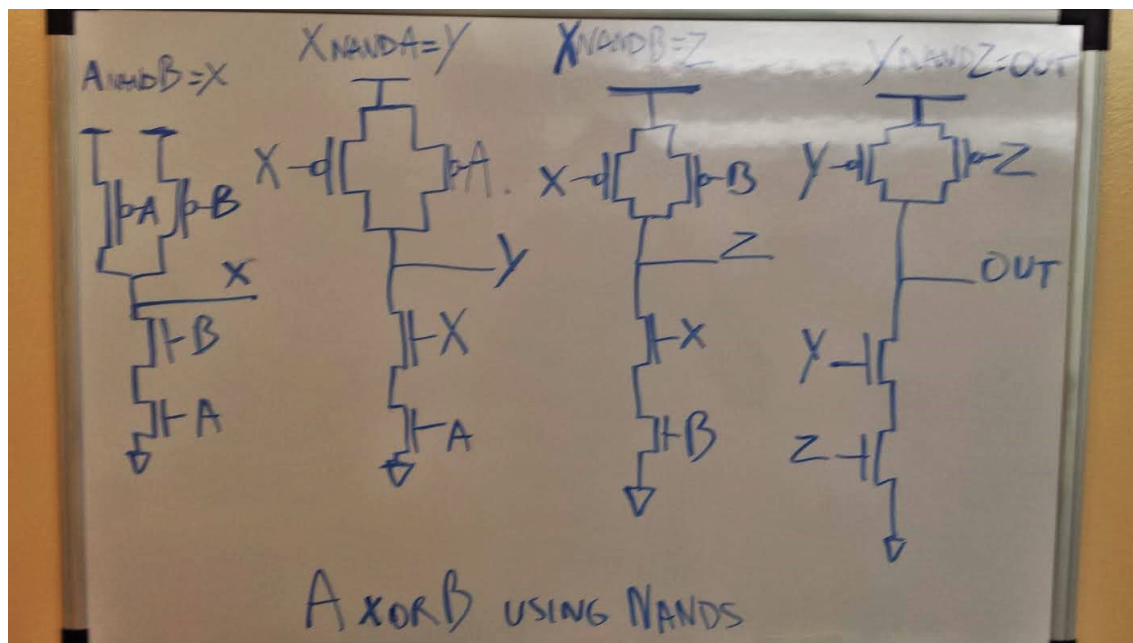| A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0

Rubric: -1.25 points for each wrong cell

(b) Generating a transistor level circuit from the truth table – **10 points**

Many possible solutions are expected. One of them is using 4 NANDs, in the following way:

The transistor implementation of that (sorry, my drawings are not optimal):


Rubric: -2.5 point for each pair of inputs that are incorrect.

Extra Credit (5 points):

Rubric: Although the exercise says "in addition to", we only want the **transistor** here. They are doing the gate drawing for 3.16 in HW3.

One way the students could attempt this problem is to build the PLA for the table and them from it build the transistor. Of course, this is not the only solution.

The result would be this: (again, not optimal drawings, sorry)
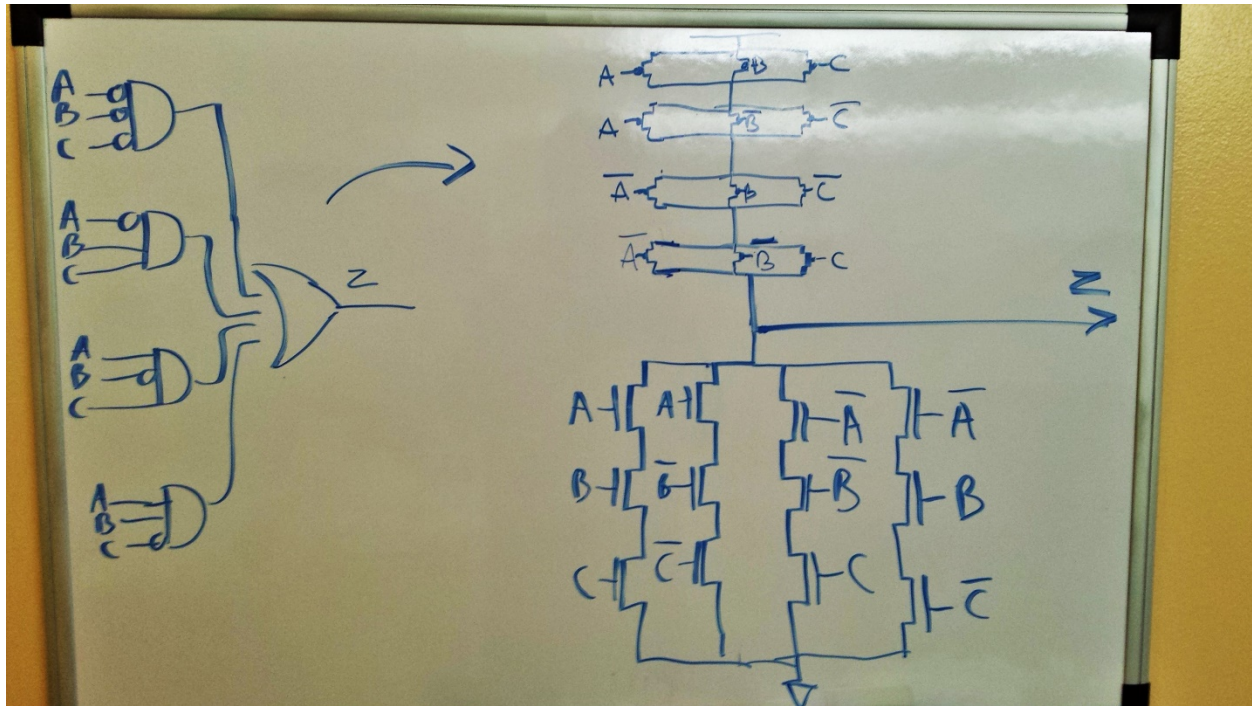
Rubric: The drawings here will vary, so the important thing is the inputs work. Since its Extra Credit, the student gets 5 points if and only if they get everything correct (all inputs work).