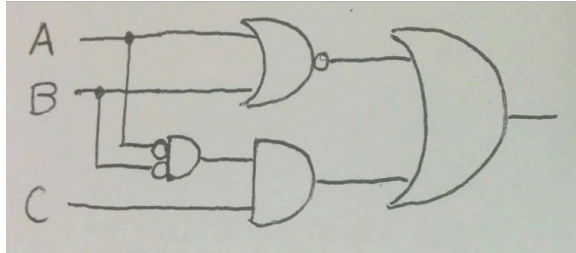CS240 Supplemental Practice – Gates

1) For the following circuit, answer the following questions

   a. Write out its truth table:

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

   b. What is the equivalent, unsimplified Boolean expression? In other words, what is the Boolean algebra translation of the circuit above?

   (A + B)' + (A'B')C

   c. What is the sum of products expression of the truth table?

   A'B'C + A'B'C'

   d. Simplify your answer from part b using Boolean algebra laws. As a sanity check, you should be able to simplify your expression from part c and arrive at the same answer.

   (A + B)' + (A'B')C - Original equation from part b
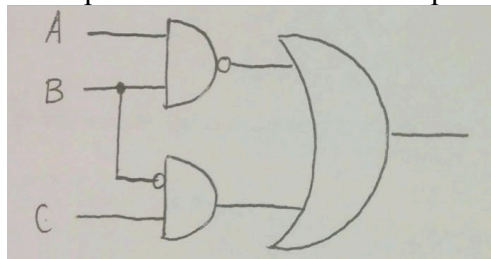   A'B' + (A'B')C – DeMorgan's Law
   A'B' – Absorption

   A'B'C + A'B'C' – Original equation from part c
   A'B' - Combining

Extra practice: answer the same questions above with this circuit

a. Write out its truth table:

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

b. What is the equivalent, unsimplified Boolean expression? In other words, what is the Boolean algebra translation of the circuit above?

$(AB)' + B'C$

c. What is the sum of products expression of the truth table?

$A'B'C' + A'B'C + A'BC' + A'BC + AB'C' + AB'C$

d. Simplify your answer from part b using Boolean algebra laws. As a sanity check, you should be able to simplify your expression from part c and arrive at the same answer.
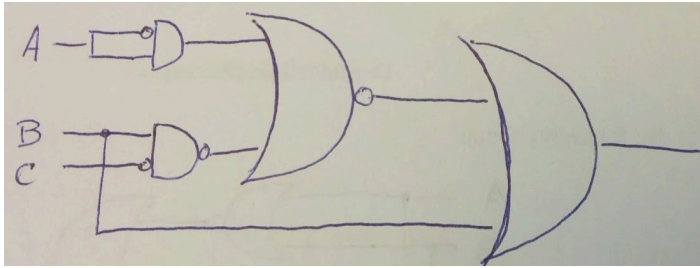
$(AB)' + B'C$ – Original equation from part b
$A' + B' + B'C$ – DeMorgan's
$A' + B'$ - Absorption

$A'B'C' + A'B'C + A'BC' + A'BC + AB'C' + AB'C$ - Original equation from part c
$A'B' + A'BC' + A'BC + AB'C' + AB'C$ – Absorption
$A'B' + A'B + AB'C' + AB'C$ – Absorption
$A'B' + A'B + AB'$ – Absorption
$A' + AB'$ – Absorption
$(A' + A)(A' + B')$ – Distributive

(1)(A' + B') – Inverse
A' + B' - Identity

2) For the Boolean expression: (A'A + (BC')')' + B
   a. Draw the unsimplified circuit:

   b. Write out its truth table:

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

   c. Simplify or shorten the expression step-by-step using Boolean algebra laws, and write the corresponding laws next to each step

$(A'A + (BC')')' + B$ – Original equation
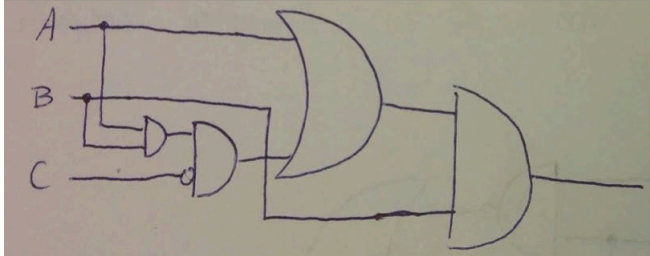$(0 + (BC')')' + B$ – Inverse
$((BC')')' + B$ – Identity
$(BC') + B$ – Negation
B - Absorption

Extra practice: answer the questions above with this Boolean algebra expression (A + ABC')B

     a. Draw the unsimplified circuit:

     b. Write out its truth table:

A	B	C	Out
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	1
1	1	1	1

     c. Simplify or shorten the expression step-by-step using Boolean algebra laws, and write the corresponding laws next to each step

(A + ABC')B – Original Equation
AB – Absorption