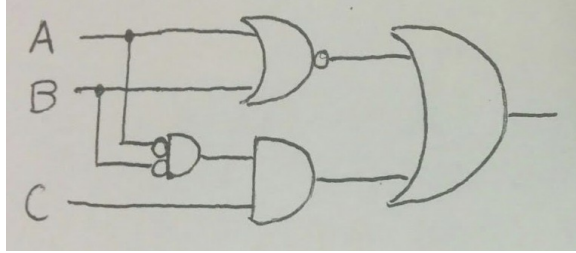CS240 Supplemental Practice – Gates

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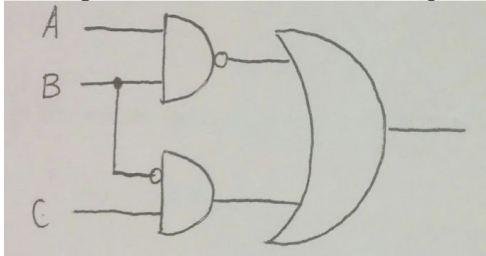
(A + B)' + (A'B')C - Original expression from part b
A'B' + (A'B')C – DeMorgan's Law
A'B' – Absorption

A'B'C + A'B'C' – Original expression 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 expression 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 expression from part c
A'B' + A'BC' + A'BC + AB'C' + AB'C – Combining
A'B' + A'B + AB'C' + AB'C – Combining
A'B' + A'B + AB' – Combining
A' + AB' – Combining
(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:
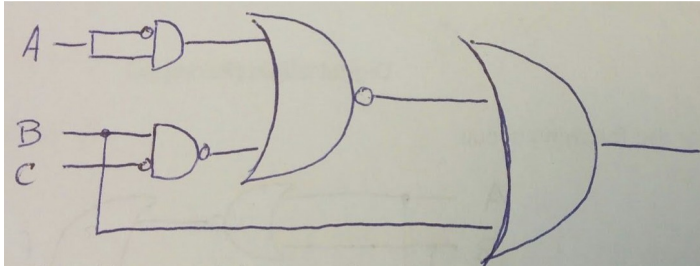
   b. Write out its truth table:

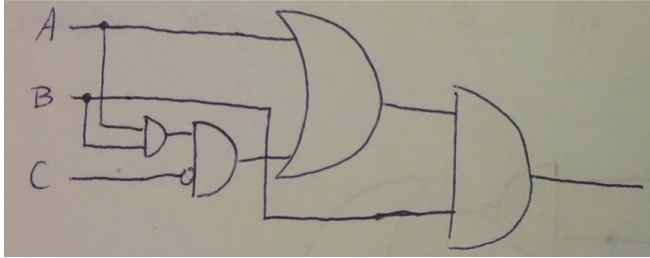| A	B	C	Out
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

   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 expression
(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 expression
AB – Absorption