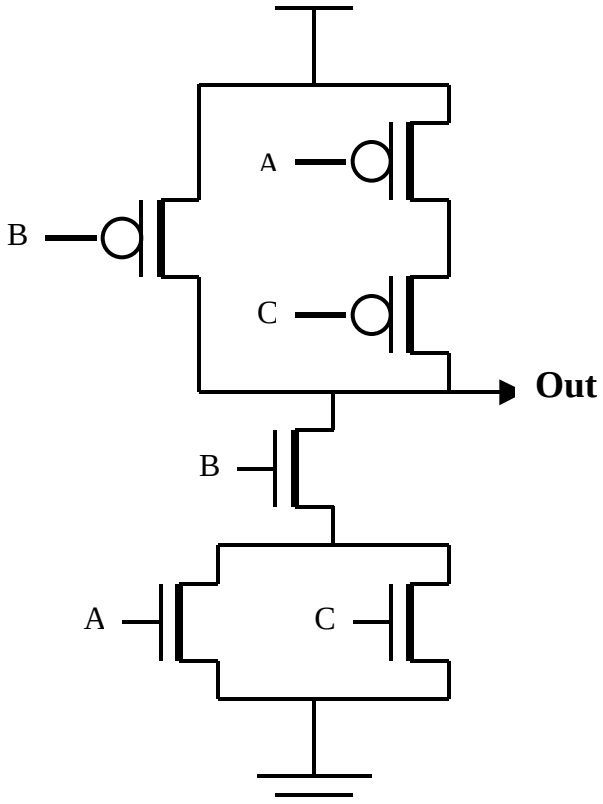
Transistor-Level Circuit Understanding

For the following switch level circuit, complete the truth table computed. If a floating or shorted output is detected, indicate that in the truth table. If no floats or shorts are detected, write the Boolean expression computed by the circuit.

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

"Out" is "1" if B is "0" or A' and C' are both "0".



Write the Boolean expression for this function, Out = **B' + A'C'**

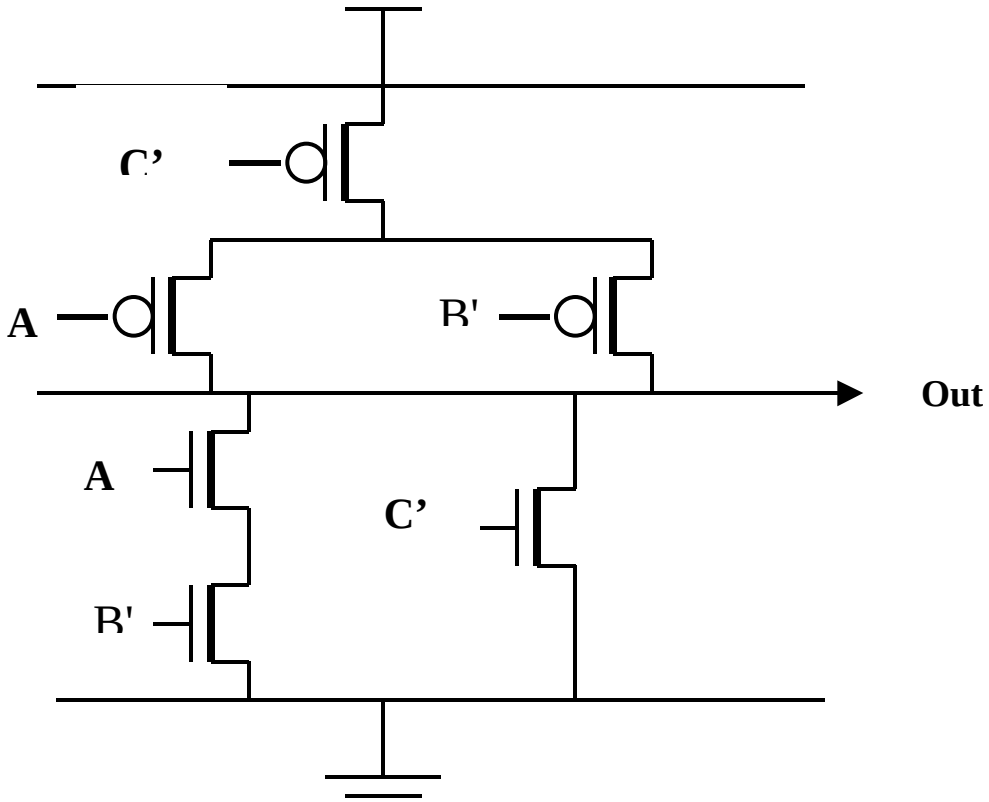
Given the Boolean expression: Out = A'C + ABC **= C(A'+AB) = C(A'+B)**

(if logic expression is not simplified, there should be 10 FET's below)

Complete the truth table.

A	B	C	Out	**Note**
0	0	0	0	
0	0	1	1	A'C=1
0	1	0	0	
0	1	1	1	A'C=1
1	0	0	0	
1	0	1	0	
1	1	0	0	
1	1	1	1	ABC = 1

Draw the CMOS transistor diagram. Assume A, A', B, B', C, C' signals are available.



Given the truth table.

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

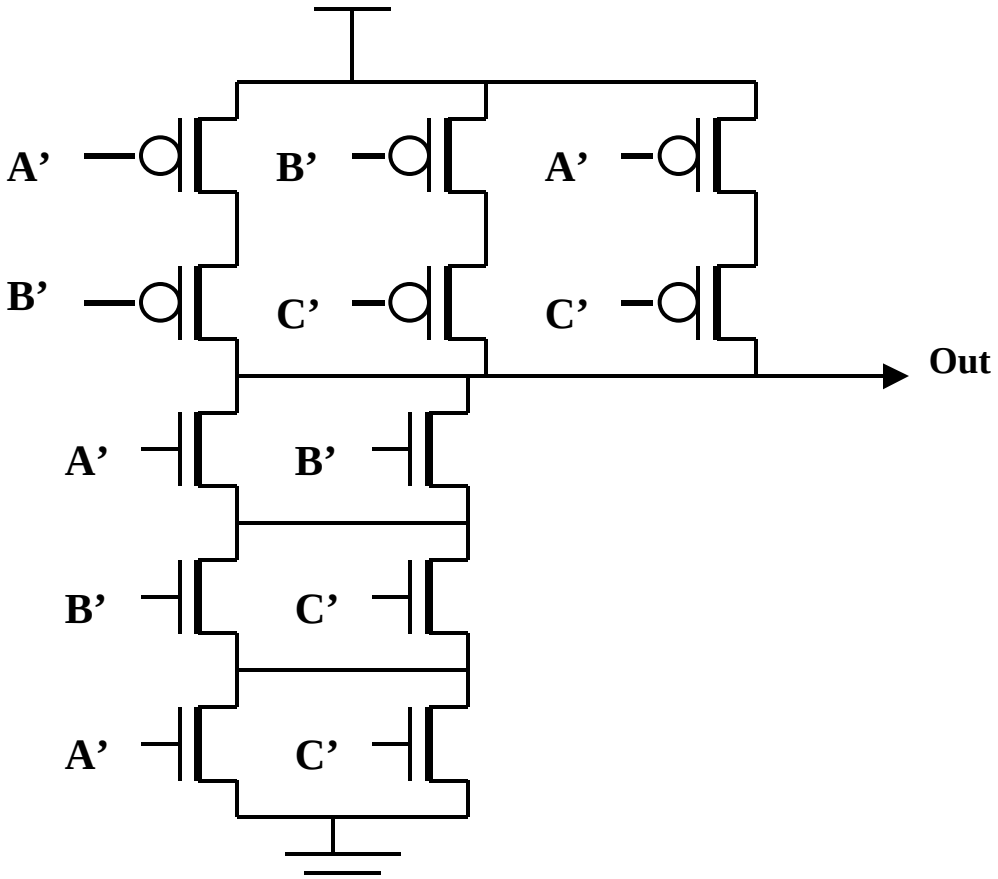
Write the Boolean expression as 3 terms: Out = **AB +BC + AC from observation that Out is "1" whenever any two inputs are one).**

By the minterm approach: Out = A'BC +AB'C + ABC' + ABC

Using Boolean Equalities: A'BC + ABC = BC and ABC = ABC + ABC +ABC

OUT = AB + BC + AC

Draw the CMOS transistor diagram. Assume A, A', B, B', C, C' signals are available.



Bonus – use a Karnaugh map to find the simplest logic expression for Problem 3. There are three Essential Prime Implements, AC (blue), BC (green), and AB (red).

A \ BC	00	01	11	10
0	0	0	1	0
1	0	1	1	1