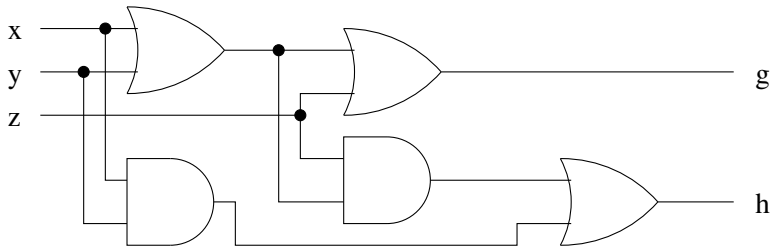
CMPT 295: Combinational Logic Questions

NOTE: In the following Boolean expressions, x' is another way of indicating "the complement of x."

1. For the Boolean function $F(A, B, C) = AB'C + A'C' + AB$ find "algebraic" representations as follows:
   (a) An equivalent representation using only AND and NOT.
   (b) An equivalent representation using only OR and NOT.

2. Consider the function: $f(a, b, c) = (a'b'c' + a'b'c + ab'c + abc)'$
   (a) Draw the logic diagram for the digital system whose functional specification is given by this expression.
   (b) What is the dual of f?
   (c) Draw the logic diagram for the digital system whose functional specification is given by the dual of f.

3. Construct a **behavioral description** for the following circuit, providing your functional specification in 2 ways - algebraically and as a function table:



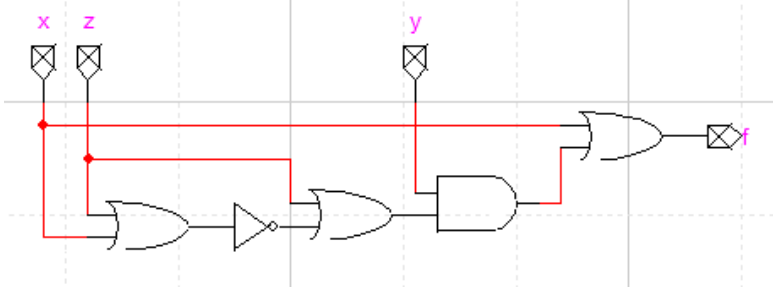
4. Implement the following function using only 3 AND gates and any NOT gates as required.

$$H(X, Y, Z) = X' \cdot Y' \cdot Z + X' \cdot Y \cdot Z' + X \cdot Y' \cdot Z + X \cdot Y \cdot Z'$$

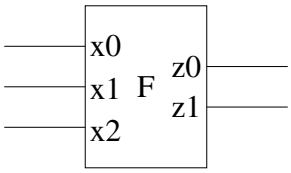
5. Simplify the following to an expression that can be implemented with as few gates as possible.:

$$\overline{A} \cdot \overline{C} + \overline{A} \cdot B \cdot C + \overline{B} \cdot C =$$

6. Construct a simpler circuit for a function `f`, currently implemented as follows:



7. A digital system has the following behavioral description:



x2	x1	x0	z1	z0
0	0	0	0	1
0	0	1	1	0
0	1	0	1	1
0	1	1	0	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	1
1	1	1	0	0

(a) Construct Boolean expressions for the functional specification of this system.

(b) Using the laws of Boolean algebra, obtain a simpler but equivalent functional specification using only AND, OR, and NOT.

(c) Draw the logic diagram from the simplified specification.