WEEK 3 DISCUSSION WORKSHEET: BOOLEAN ALGEBRA

(1) Evaluate the logical expressions with $x = y = 1$ and $w = z = 0$
   (a) $xy\overline{wz}$
   (b) $x\overline{y} + z(\overline{w + z})$
   (c) $\overline{z}y\overline{x}(1 + w)$
   (d) $xy\overline{z} + z\overline{w}$
   (e) $\overline{(z + y)(w + x)}$

(2) Use the laws of Boolean algebra to show that the two Boolean expressions in each pair are equivalent.
   (a) $xy + x\overline{y} = x$
   (b) $x + xy = x$
   (c) $x(\overline{y} + x) = x$
   (d) $\overline{x + \overline{y}} + \overline{x}\overline{y} = \overline{x}$

(3) A function f is defined by

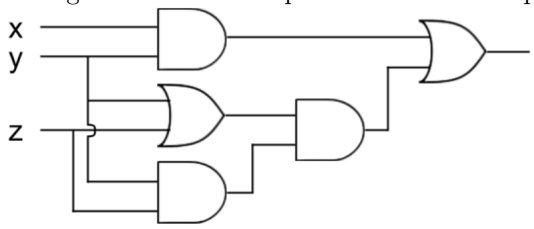
x	y	z	$f(x, y, z)$
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

   (a) The function g is defined as $g(x, y, z) = \overline{x}\overline{y}z + \overline{x}yz + xyz$ Give a set of values for the variables x, y, and z, for which the functions f and g have different output values
   (b) The function g is defined as $h(x, y, z) = \overline{x}\overline{y}z + \overline{x}y\overline{z} + \overline{x}yz + xy\overline{z}$ Give a set of values for the variables x, y, and z, for which the functions f and h have different output values

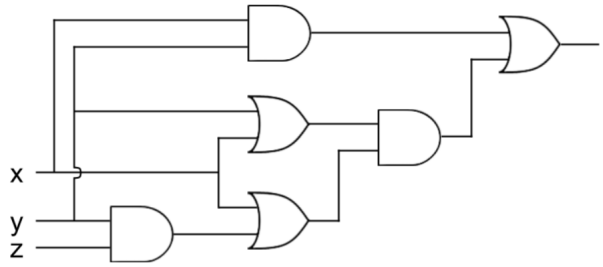
(4) For each expression below, give an equivalent expression that uses only the NAND operation. Then give an equivalent expression that uses only the NOR operation.
   (a) $\overline{x} + y$
   (b) $\overline{x}\overline{y}$
   (c) $(x + y)z$

(5) Give an equivalent Boolean expression for each circuit. Then use the laws of Boolean algebra to find a simpler circuit that computes the same function.

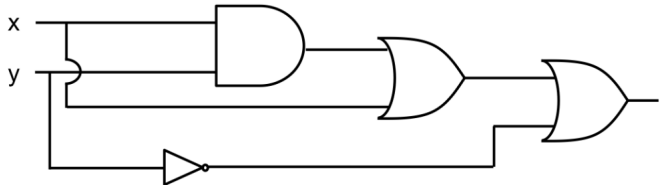
(a)



(b)



(c)



(d)