



5.

A	B	C	D	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Identity Name	AND Form	OR Form
Identity Law	$1x = x$	$0+x = x$
Null (or Dominance) Law	$0x = 0$	$1+x = 1$
Idempotent Law	$xx = x$	$x+x = x$
Inverse Law	$x\bar{x} = 0$	$x+\bar{x} = 1$
Commutative Law	$xy = yx$	$x+y = y+x$
Associative Law	$(xy)z = x(yz)$	$(x+y)+z = x+(y+z)$
Distributive Law	$x+yz = (x+y)(x+z)$	$x(y+z) = xy + xz$
Absorption Law	$x(x+y) = x$	$x+xy = x$
DeMorgan's Law	$\overline{(xy)} = \bar{x}\bar{y}$	$\overline{(x+y)} = \bar{x}\bar{y}$
Double Complement Law	$\bar{\bar{x}} = x$	

For the Boolean function F represented in the truth table:

- write the sum-of-products (SOP) Boolean expression (i.e., where the 1's are in the F column,  $F = \overline{A}BCD + \overline{A}BC\bar{D} + \dots$ )
- draw the unsimplified circuit for this SOP expression. Also, determine the number of gate delays and circuit complexity (# gates + # inputs into those gates)
- using the identities of Boolean algebra (or a K-map), simplify this function F as much as you can
- draw the simplified circuit for your answer in part (c). Also, determine the number of gate delays and circuit complexity (# gates + # inputs into those gates) of this circuit