

Identities

TABLE 1-1 Basic Identities of Boolean Algebra

(1) $x + 0 = x$	(2) $x \cdot 0 = 0$
(3) $x + 1 = 1$	(4) $x \cdot 1 = x$
(5) $x + x = x$	(6) $x \cdot x = x$
(7) $x + x' = 1$	(8) $x \cdot x' = 0$
(9) $x + y = y + x$	(10) $xy = yx$
(11) $x + (y + z) = (x + y) + z$	(12) $x(yz) = (xy)z$
(13) $x(y + z) = xy + xz$	(14) $x + yx = (x + y)(x + z)$
(15) $(x + y)' = x'y'$	(16) $(xy)' = x' + y'$
(17) $(x')' = x$	

Questions

- Simplify the following expressions:

1. $A + AB$

2. $AB + AB'$

3. $A'BC + AC$

4. $A'B + ABC' + ABC$

5. $AB + A(CD + CD')$

Answers

- $A + AB = A(1 + B) = A$
- $AB + AB' = A(B + B') = A$
- $A'BC + AC = C(A'B + A) = C(A' + A)(B + A) = (A + B)C$
- $A'B + ABC' + ABC = A'B + AB(C' + C) = A'B + AB = B(A' + A) = B$
- $AB + AC(D + D') = A(B + C)$

Question

- Determine the means of a truth table the validity of De Morgan's Theorem for three variables : $(ABC)' = A' + B' + C'$

Answer

A B C	$A \cdot B \cdot C$	$(A \cdot B \cdot C)'$	A'	B'	C'	$A' + B' + C'$
0 0 0	0	1	1	1	1	1
0 0 1	0	1	1	1	0	1
0 1 0	0	1	1	0	1	1
0 1 1	0	1	1	0	0	1
1 0 0	0	1	0	1	1	1
1 0 1	0	1	0	1	0	1
1 1 0	0	1	0	0	1	1
1 1 1	1	0	0	0	0	0

Question

- List the truth Table for the three value exclusive-OR (odd) function: $x = A \oplus B \oplus C$

Answer

A B C	$A \oplus B$	$A \oplus B \oplus C$
0 0 0	0	0
0 0 1	0	1
0 1 0	1	1
0 1 1	1	0
1 0 0	1	1
1 0 1	1	0
1 1 0	0	0
1 1 1	0	1