SARA KAZEMI

jan feb mar apr may june july aug sept oct nov dec
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Operation	Symbol	Precedence
NOT	'	Highest
AND	•	Mid
OR	+	Lowest

Exercises 5.2

1. Prove the identity property expressed by:

$x \cdot 1 = x$ and $x + 0 = x$

x	$x \cdot 1$	$x = x \cdot 1$
0	$0 \cdot 1 = 0$	$0 = 0$
1	$1 \cdot 1 = 1$	$1 = 1$

x	$x + 0$	$x = x + 0$
0	$0 + 0 = 0$	$0 = 0$
1	$1 + 0 = 1$	$1 = 1$

2. Prove the commutative property expressed by:

$x \cdot y = y \cdot x$ and $x + y = y + x$

x	y	$x \cdot y$	$y \cdot x$	$x \cdot y = y \cdot x$
0	0	$0 \cdot 0 = 0$	$0 \cdot 0 = 0$	$0 = 0$
0	1	$0 \cdot 1 = 0$	$1 \cdot 0 = 0$	$0 = 0$
1	0	$1 \cdot 0 = 0$	$0 \cdot 1 = 0$	$0 = 0$
1	1	$1 \cdot 1 = 1$	$1 \cdot 1 = 1$	$1 = 1$

x	y	$x + y$	$y + x$	$x + y = y + x$
0	0	$0 + 0 = 0$	$0 + 0 = 0$	$0 = 0$
0	1	$0 + 1 = 1$	$1 + 0 = 1$	$0 = 0$
1	0	$1 + 0 = 1$	$0 + 1 = 1$	$0 = 0$
1	1	$1 + 1 = 1$	$1 + 1 = 1$	$1 = 1$

3. Annulment Law - a term AND'ed with a Ø equals Ø
- a term OR'ed with a 1 equals 1

Prove the annulment property expressed by:

$x \cdot \emptyset = \emptyset$ and $x + 1 = 1$

x	$x \cdot \emptyset$	$x \cdot \emptyset = \emptyset$
0	$0 \cdot 0 = 0$	$\emptyset = \emptyset$
1	$1 \cdot 0 = 0$	$\emptyset = \emptyset$

x	$x + 1$	$x + 1 = 1$
Ø	$\emptyset + 1 = 1$	$1 = 1$
1	$1 + 1 = 1$	$1 = 1$

4. Prove the complement property expressed by:

$x \cdot x' = \emptyset$ and $x + x' = 1$

x	x'	$x \cdot x'$	$x \cdot x' = 0$
0	1	$0 \cdot 1 = 0$	$0 = 0$
1	0	$1 \cdot 0 = 0$	$0 = 0$

x	x'	$x + x'$	$x + x' = 1$
0	1	$0 + 1 = 1$	$1 = 1$
1	0	$1 + 0 = 1$	$1 = 1$

5. Prove the idempotent property expressed by:

$x \cdot x = x$ and $x + x = x$

x	$x \cdot x$	$x \cdot x = x$
0	$0 \cdot 0 = 0$	$0 = 0$
1	$1 \cdot 1 = 1$	$1 = 1$

x	$x + x$	$x + x = x$
0	$0 + 0 = 0$	$0 = 0$
1	$1 + 1 = 0$	$1 = 1$

6. Prove the distributive property expressed by:

$x \cdot (y + z) = x \cdot y + x \cdot z$

x	y	z	$y+z$	$x \cdot (y+z)$	$x \cdot y$	$x \cdot z$	$x \cdot y + x \cdot z$	$x \cdot (y+z) = x \cdot y + x \cdot z$
0	0	0	$0+0=0$	$0 \cdot 0 = 0$	$0 \cdot 0 = 0$	$0 \cdot 0 = 0$	$0+0=0$	$0 = 0$
0	0	1	$0+1=1$	$0 \cdot 1 = 0$	$0 \cdot 0 = 0$	$0 \cdot 1 = 0$	$0+0=0$	$0 = 0$
0	1	0	$+0=1$	$0 \cdot 1 = 0$	$0 \cdot 1 = 0$	$0 \cdot 0 = 0$	$0+0=0$	$0 = 0$
0	1	1	$1+1=1$	$0 \cdot 1 = 0$	$0 \cdot 1 = 0$	$0 \cdot 1 = 0$	$0+0=0$	$0 = 0$
1	0	0	$0+0=0$	$1 \cdot 0 = 0$	$1 \cdot 0 = 0$	$1 \cdot 0 = 0$	$0+0=0$	$0 = 0$
1	0	1	$0+1=1$	$1 \cdot 1 = 1$	$1 \cdot 0 = 0$	$1 \cdot 1 = 1$	$0+1=1$	$1 = 1$
1	1	0	$1+0=$	$1 \cdot 1 = 1$	$1 \cdot 1 = 1$	$1 \cdot 0 = 0$	$1+0=1$	$1 = 1$
1	1	1	$1+1=1$	$1 \cdot 1 = 1$	$1 \cdot 1 = 1$	$1 \cdot 1 = 1$	$1+1=1$	$1 = 1$

Cont'd on next

6. (cont'd)

Prove the distributive property expressed by

$x + y \cdot z = (x+y) \cdot (x+z)$

x	y	z	$y \cdot z$	$x + y \cdot z$	$x+y$	$y+z$	$(x+y)\cdot(x+z)$	$x+y\cdot z = (x+y)(x+z)$
0	0	0	$0\cdot0=0$	$0+0=0$	$0+0=0$	$0+0=0$	$0\cdot0=0$	$0=0$
0	0	1	$0\cdot1=0$	$0+0=0$	$0+0=0$	$0+1=1$	$0\cdot1=0$	$0=0$
0	1	0	$1\cdot0=0$	$0+0=0$	$0+1=1$	$0+0=0$	$1\cdot0=0$	$0=0$
0	1	1	$1\cdot1=1$	$0+1=1$	$0+1=1$	$0+1=1$	$1\cdot1=1$	$1=1$
1	0	0	$0\cdot0=0$	$1+0=1$	$1+0=1$	$1+0=1$	$1\cdot1=1$	$1=1$
1	0	1	$0\cdot1=0$	$1+0=1$	$1+0=1$	$1+1=1$	$1\cdot1=1$	$1=1$
1	1	0	$1\cdot0=0$	$1+0=1$	$1+1=1$	$1+0=1$	$1\cdot1=1$	$1=1$
1	1	1	$1\cdot1=1$	$1+0=1$	$1+1=1$	$1+1=1$	$1\cdot1=1$	$1=1$

Exercise 5-4

1. Show that the following equations represent the same functionality, ie, that the sum of minterms & product of maxterms are complementary.

Eq. 5.3.1

$$F(x,y,z) = (x+y'+z)\cdot(x+y'+z')\cdot(x'+y+z)\cdot(x'+y'+z')$$
$$= M_2 \cdot M_3 \cdot M_4 \cdot M_7$$
$$= \Pi(2,3,4,7)$$

Maxterms

Eq. 5.3.2

$$F(x,y,z) = (x'\cdot y'\cdot z') + (x'\cdot y'\cdot z) + (x\cdot y'\cdot z) + (x\cdot y\cdot z')$$
$$= m_0 + m_1 + m_5 + m_6$$
$$= \Sigma(0,1,5,6)$$

Minterms

x	y	z	$F(x,y,z) = \Sigma(0,1,5,6)$		$F(x,y,z) = \Pi(2,3,4,7)$	
0	0	0	$x'\cdot y'\cdot z' \rightarrow \boxed{m_0}$	$1+0+0+0=1$	$x+y+z \rightarrow M_0$	$1\cdot1\cdot1\cdot1=1$
0	0	1	$x'\cdot y'\cdot z \rightarrow \boxed{m_1}$	$0+1+0+0=1$	$x+y+z' \rightarrow M_1$	$1\cdot1\cdot1\cdot1=1$
0	1	0	$x'\cdot y\cdot z' \rightarrow m_2$	$0+0+0+0=0$	$x+y'+z \rightarrow \boxed{M_2}$	$\emptyset$
0	1	1	$x'\cdot y\cdot z \rightarrow m_3$	$0+0+0+0=0$	$x+y'+z' = \boxed{M_3}$	$1\cdot0\cdot1\cdot1=0$
1	0	0	$x\cdot y'\cdot z' \rightarrow m_4$	$0+0+0+0=0$	$x'+y+z = \boxed{M_4}$	$1\cdot1\cdot0\cdot1=0$
1	0	1	$x\cdot y'\cdot z \rightarrow \boxed{m_5}$	$0+0+1+0=0$	$x'+y+z' = M_5$	$1\cdot1\cdot1\cdot1=1$
1	1	0	$x\cdot y\cdot z' \rightarrow \boxed{m_6}$	$0+0+0+1=1$	$x'+y'+z = M_6$	$1\cdot1\cdot1\cdot1=1$
1	1	1	$x\cdot y\cdot z \rightarrow m_7$	$0+0+0+0=0$	$x'+y'+z' = \boxed{M_7}$	$1\cdot1\cdot1\cdot0=0$