11.2 Review

1 $(a \vee b) \vee c = a \vee (b \vee c)$
$(a \wedge b) \wedge c = a \wedge (b \wedge c)$

2 $a \vee b = b \vee a$
$a \wedge b = b \wedge a$

3 $a \wedge (b \vee c) = (a \wedge b) \vee (a \wedge c)$
$a \vee (b \wedge c) = (a \vee b) \wedge (a \vee c)$

4 $a \vee 0 = a$ $\quad a \wedge 1 = a$

5 $a \vee \bar{a} = 1$ $\quad a \wedge \bar{a} = 0$

6. Boolean expressions are equal if they have the values for all possible assignments of bits to the literals

7. Combinational circuits are equivalent if, whenever the circuits receive the same inputs, they produce the same outputs.

8. Let C_1 and C_2 be combinational circuits represented, respectively, by the Boolean expression X_1 and X_2. Then C_1 and C_2 are equivalent if and only if $X_1 = X_2$

Section 11-2

#1

x_1	x_2	$\overline{x_1 \wedge x_2}$	$\overline{x}_1 \vee \overline{x}_2$
1	1	0	0
1	0	1	1
0	1	1	1
0	0	1	1

#3

x_1	x_2	x_3	$\overline{x_1 \vee \overline{x}_2} \wedge (\overline{x}_1 \wedge x_3)$	$\overline{x}_1 (x_2 + x_3)$
1	1	1	0	0
1	1	0	0	0
1	0	1	0	0
1	0	0	0	0
0	1	1	1	1
0	1	0	1	1
0	0	1	1	1
0	0	0	0	0

#5

x_1	x_2	x_3	x_4	$x_1 x_2 + x_3 x_4$	$(x_1 \vee x_3) \wedge (x_2 \vee x_3) \wedge (x_2 \vee x_4) \wedge (x_1 \vee x_4)$
1	1	1	1	1	1
1	1	1	0	1	1
1	1	0	1	1	1
1	1	0	0	1	1
1	0	1	1	1	1
1	0	1	0	0	0
1	0	0	1	0	0
1	0	0	0	0	0
0	1	1	1	1	1
0	1	1	0	0	0
0	1	0	1	0	0
0	1	0	0	0	0
0	0	1	1	1	1
0	0	1	0	0	0
0	0	0	1	0	0
0	0	0	0	0	0

#7 $\underbrace{X_1 \vee (X_1 \wedge X_2)}_{A} = \underbrace{X_1}_{B}$

X_1	X_2	A	B
1	1	1	1
1	0	1	1
0	1	0	0
0	0	0	0

✓

(9)

X_1	X_2	X_3	$X_1 \wedge \overline{X_2 \wedge X_3}$	$(X_1 \wedge \overline{X_2}) \vee (X_1 \wedge \overline{X_3})$
1	1	1	0	0
1	1	0	1	1
1	0	1	1	1
1	0	0	1	1
0	1	1	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	0	0

✓

(11) $\overline{\overline{X}} = X$

X	$\overline{X}$	$\overline{\overline{X}}$
0	1	0
1	0	1

✓

(13)

X_1	X_2	X_3	$\overline{X_1} \wedge ((X_2 \wedge X_3) \vee (X_1 \wedge X_2 \wedge X_3))$	$X_2 \wedge X_3$
1	1	1	1	1
1	1	0	0	0
1	0	1	0	0
1	0	0	0	0
0	1	1	0	1
0	1	0	0	0
0	0	1	0	0
0	0	0	0	0

NOT EQUAL

(15)

x_1	x_2	x_3	x_4	$(x_1 \vee x_2) \wedge \overline{x_3 \vee x_4} \wedge x_3 \wedge \overline{x_2}$
1	1	1	1	0
1	1	1	0	0
1	1	0	1	0
1	1	0	0	0
1	0	1	1	0
1	0	1	0	1
1	0	0	1	0
1	0	0	0	0
0	1	1	1	0
0	1	1	0	0
0	1	0	1	0
0	1	0	0	0
0	0	1	1	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	0

$\neq \emptyset$

(17)