HW3 Solutions

1.

a) $xyz + x(yz)' + x'(y+z) + (xyz)'$ b) $(x + y')(x' + z')(y' + z')$

Ans.

a)

x	y	z	xyz	$x(yz)'$	$(xyz)'$	Sum	$x'(y+z)$
0	0	0	0	0	1	1	0
0	0	1	0	0	1	1	1
0	1	0	0	0	1	1	1
0	1	1	0	0	1	1	1
1	0	0	0	1	1	1	0
1	0	1	0	1	1	1	0
1	1	0	0	1	1	1	0
1	1	1	1	0	0	1	0

b)

x	y	z	$x + y'$	$x' + z'$	$y' + z'$	Product
0	0	0	1	1	1	1
0	0	1	1	1	1	1
0	1	0	0	1	1	0
0	1	1	0	1	0	0
1	0	0	1	1	1	1
1	0	1	1	0	1	0
1	1	0	1	1	1	1
1	1	1	1	0	0	0

2.

Ans.

$$\begin{aligned} F(x,y,z) &= (x'+y)(x+z)(y'+z)' \\ F'(x,y,z) &= ((x'+y)(x+z)(y'+z)')' \\ &= (x'+y)'+(x+z)'+(y'+z)'' \\ &= xy'+x'z'+(y'+z) \text{ (not simplified)} \end{aligned}$$

3.

Ans.

a.

x	y	xy	xy'	$xy + xy'$
0	0	0	0	0
0	1	0	0	0
1	0	0	1	1
1	1	1	0	1

The final column is equal to x.

b.

$xy + xy'$	$=$	$x(y + y')$	*Distributive*
	$=$	$x(1)$	*Inverse*
	$=$	x	*Identity*

4.

a) $F(x, y, z) = x'yz + xz$

$$
\begin{aligned}
x'yz + xz &= x'yz + xz(1) && \textit{Identity} \\
&= x'yz + xz(y + y') && \textit{Inverse} \\
&= x'yz + xzy + xzy' && \textit{Distributive} \\
&= x'yz + (xzy + xzy) + xzy' && \textit{Idempotent} \\
&= (x'yz + xzy) + (xzy + xzy') && \textit{Associative} \\
&= (x'yz + xyz) + (xyz + xy'z) && \textit{Commutative} \\
&= (x' + x)yz + xz(y + y') && \textit{Distributive} \\
&= (1)yz + xz(1) && \textit{Inverse} \\
&= yz + xz && \textit{Identity}
\end{aligned}
$$

b) $F(x, y, z) = (x' + y + z')' + xy'z' + yz + xyz$

$$
\begin{aligned}
(x' + y + z')' + xy'z' + yz + xyz &= (xy'z) + xy'z' + yz + xyz && \textit{DeMorgan} \\
&= xy'(z + z') + yz + xyz && \textit{Distributive} \\
&= xy'(1) + yz + xyz && \textit{Inverse} \\
&= xy' + yz + xyz && \textit{Identity} \\
&= xy' + yz && \textit{Absorption}
\end{aligned}
$$

5.

x	y	z	F
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Ans.
$F(x, y, z) = x'y'z' + x'yz' + xy'z + xyz' + xyz$

.

6.

a) $F(x, y, z) = x'y'z' + x'yz + x'yz'$

b) $F(x, y, z) = x'y'z' + x'yz' + xy'z' + xyz'$

c) $F(x, y, z) = y'z' + y'z + xyz'$

Ans.

a) $x'y'z' + x'yz + x'yz'$

Simplifies to: $x'y + x'z'$

x \ yz	00	01	11	10
0	1	0	1	1
1	0	0	0	0

b) $x'y'z' + x'yz' + xy'z' + xyz'$

Simplifies to: z'

x \ yz	00	01	11	10
0	1	0	0	1
1	1	0	0	1

c) $y'z' + y'z + xyz'$

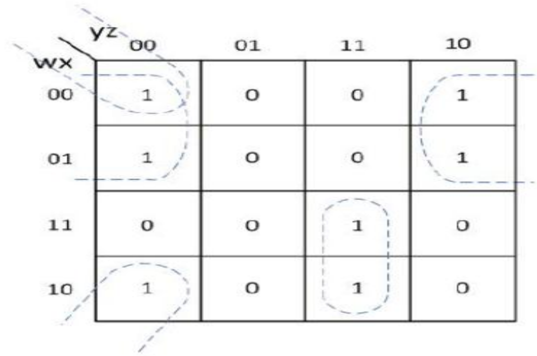
Simplifies to: $y' + xz'$

x \ yz	00	01	11	10
0	1	1	0	0
1	1	1	0	1

7.

a)

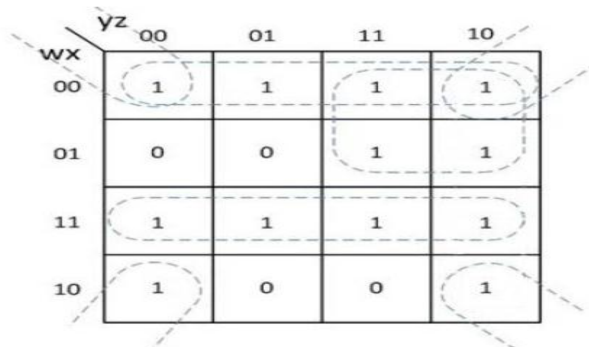
wx \ yz	00	01	11	10
00	1	0	0	1
01	1	0	0	1
11	0	0	1	0
10	1	0	1	0



Ans.
$w'z' + \cancel{x}'y'z' + wyz$

b)

wx \ yz	00	01	11	10
00	1	1	1	1
01	0	0	1	1
11	1	1	1	1
10	1	0	0	1



Ans. $w'x' + wx + w'y + x'z'(orw'x' + wx + xy + x'z')$

c)

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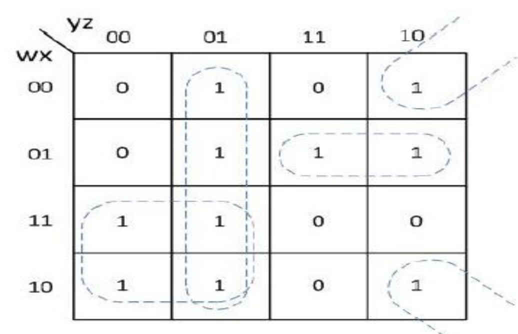
wx \ yz	00	01	11	10
00	0	1	0	1
01	0	1	1	1
11	1	1	0	0
10	1	1	0	1



Ans. $wy' + y'z + w'xy + x'yz'$
