CPSC 2610
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Assignment 2

1.

a. $(x+y)' = x'y'$

x	y	x+y	(x+y)'	x'	y'	x'y'
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

b. $(xy)' = x' + y'$

x	y	xy	(xy)'	x'	y'	x'+y'
0	0	0	1	1	1	1
0	1	0	1	1	0	1
1	0	0	1	0	1	1
1	1	1	0	0	0	0

2.

a. $xyz' + x'yz + xyz + x'yz'$

$= xy(z + z') + x'y(z + z')$	Postulate 4(a)
$= xy.1 + xy.1$	Postulate 5(a)
$= xy + xy$	Postulate 2(b)
$= xy$	Theorem 1(a)

b. $(x + y)' (x' + y)$

$= (x'y') (x' + y)$	Theorem 5(a)
$= x'y'x' + x'y'y$	Postulate 4(a)
$= (x' . x')y' + x'(y' . y)$	Theorem 4(b)
$= x'y' + x'(y' . y)$	Theorem 1(b)
$= x'y' + x' . 0$	Theorem 5(b)
$= x'y' + 0$	Theorem 2(b)
$= x'y'$	Postulate 2(a)
$= (x + y)'$	Theorem 5(a)

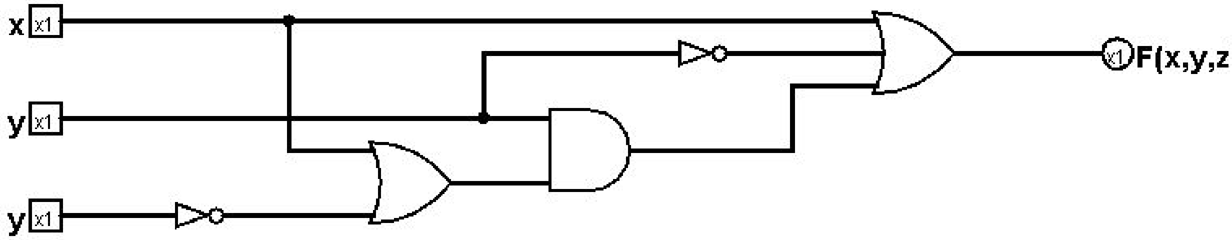
3.

a. $wxyz + w'xz + wxy'z$	
$= wxyz + wxy'z + w'xz$	Postulate 3(a)
$= wxz(y + y') + w'xz$	Postulate 4(a)
$= wxz \,.\, (1) + w'xz$	Postulate 5(a)
$= wxz + w'xz$	Postulate 2(b)
$= (w + w')xz$	Postulate 4(a)
$= 1 \,.\, xz$	Postulate 5(a)
$= xz$	Postulate 2(b)

b. $(xz' + y)' + y + xz + wy$	
$= ((xz')'y') + y + xz + wy$	Theorem 5(a)
$= x'zy' + y + xz + wy$	Theorem 3
$= x'zy' + xz + y + wy$	Postulate 3(a)
$= x'zy' + xz + y + yw$	Postulate 3(b)
$= x'zy' + xz + y$	Theorem 6(a)
$= zx'y' + xz + y$	Postulate 3(b)
$= z(x'y' + x) + y$	Postulate 4(a)
$= z((x' + x)(y' + x) + y$	Postulate 4(b)
$= z(1(y' + x)) + y$	Postulate 5(a)
$= z(y' + x) + y$	Postulate 2(b)
$= zy' + zx + y$	Postulate 4(a)
$= zy' + zx + 1.y$	Postulate 2(b)
$= zy' + zx + (z + z')y$	Postulate 5(a)
$= zy' + zx + zy + z'y$	Postulate 4(a)
$= z(y' + y) + zx + z'y$	Postulate 4(a)
$= z.1 + zx + z'y$	Postulate 5(a)
$= z + zx + z'y$	Postulate 2(b)
$= z + z'y$	Theorem 6(a)

4. $F(x,y,z) = x + y' + y(x+z')$

x	y	z	F(x,y,z)
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1



5.

a. $(A'B + CD)E + E'$

Duality: $((A' + B)(C + D)) + E \,.\, E'$

Take complement of each literal:

$((A'' + B')(C' + D')) + E' \,.\, E''$

$= ((A + B')(C' + D')) + E' \,.\, E$

$= ((A + B')(C' + D')) + 0$ Postulate 5(b)

$= (A + B')(C' + D')$ Postulate 2(a)

b. $(x' + y + z')(x + y')(x + z)$

Duality: $(x'yz') + (xy') + (xz)$

Take complement of each literal:

$(x'y'z'') + (x'y'') + (x'z')$

$= x'y'z + x'y + x'z'$

$= x'y'z + x'y(z + z') + x'z'(y + y')$

$= x'y'z + x'yz + x'yz' + x'yz' + x'y'z'$

$= x'y'z + x'y'z' + x'yz + x'yz'$

$= x'y'(z + z') + x'y(z + z')$

$= x'y'.1 + x'y.1$

$= x'y' + x'y$

$= x'(y' + y)$

$= x'.1$

$= x'$

6.

a. $F(A,B,C,D) = \sum m(2, 9, 10, 12, 14)$

$F' = \sum m(0, 1, 3, 4, 5, 6, 7, 8, 11, 13, 15)$

b. $F(x,y,z) = \prod M(1, 4, 5, 7)$

$F' = \prod M(0, 2, 3, 6)$

$= \sum m(1, 4, 5, 7)$

7.

a. $F(x,y,z) = \sum m(2, 4, 7)$

$= \prod M(0, 1, 3, 5, 6)$

b. $F(A, B, C, D) = \prod M(0, 1, 3, 4, 7, 11, 12)$

$= \sum m(2, 5, 6, 8, 9, 10, 13, 14, 15)$

8.

a. $F(x, y, z) = \sum m(0, 1, 6, 7)$

$= x'y' + xy$

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

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$= \sum m(1, 4, 7)$

$= x'y'z + xz'y' + xyz$

9.

a. $F(w, x, y, z) = \sum m(1, 4, 5, 6, 8, 13)$

$= w'y'z + w'xz' + xy'z + wxy'z'$

b. $F(A, B, C, D) = \sum m(0, 2, 3, 5, 6, 7, 8, 10, 13, 15)$

$= B'D' + A'CD + A'BD + A'BC + BCD$

10. $F(A, B, C, D) = C'D' + A'B'C + ABC' + AB'C$

$= (A + A')C'D' + A'B'C(D + D') + ABC'(D + D') + AB'C(D + D')$

$= AC'D' + A'C'D' + A'B'CD + A'B'CD' + ABC'D + ABC'D' + AB'CD + AB'CD'$

$= A(B + B')C'D' + A'(B + B')C'D' + A'B'CD + A'B'CD' + ABC'D + ABC'D' + AB'CD + AB'CD'$

$= \underline{ABC'D'} + AB'C'D' + A'BC'D' + A'B'C'D' + A'B'CD + A'B'CD' + ABC'D + \underline{ABC'D'} + AB'CD + AB'CD'$

$= ABC'D' + AB'C'D' + A'BC'D' + A'B'C'D' + A'B'CD + A'B'CD' + ABC'D + AB'CD + AB'CD'$

$= \sum m(0, 2, 3, 4, 8, 10, 11, 12, 13)$

$F = C'D' + ABC' + B'CD + A'B'C$