1. a. $F = \Sigma(1,3,4,5,7)$

	X	Y	Z	F
0	0	0	0	0
1	0	0	1	1
2	0	1	0	0
3	0	1	1	1
4	1	0	0	1
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

b. $F = \Pi(0,2,6)$

c. the Expression in (b)

d. $F_{(X,Y,Z)} = m_1 + m_3 + m_4 + m_5 + m_7$

$= m_{001} + m_{011} + m_{100} + m_{101} + m_{111}$

$= X'Y'Z + X'YZ + XY'Z' + XY'Z + XYZ$

e. $F(X,Y,Z) = M_0 \cdot M_2 \cdot M_6$

$= M_{000} \cdot M_{010} \cdot M_{110}$

$= (X+Y+Z)\cdot(X+\bar{Y}+Z)\cdot(\bar{X}+\bar{Y}+Z)$

f. $\bar{F} = \Sigma(0,2,6)$

g. $\bar{F} = \Pi(1,3,4,5,7)$

2. a.

	A	B	C	F	G	F+G	F.G
0	0	0	0	0	0	0	0
1	0	0	1	1	1	1	1
2	0	1	0	1	0	1	0
3	0	1	1	0	0	0	0
4	1	0	0	0	1	1	0
5	1	0	1	1	0	1	0
6	1	1	0	0	0	0	0
7	1	1	1	1	1	1	1

d. (Same result in c)

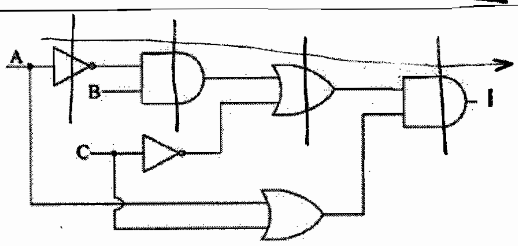
b. $F = \Sigma(1,2,5,7)$
$= \Pi(0,3,4,6)$

$G = \Pi(0,2,3,5,6)$
$= \Sigma(1,4,7)$

c. $F+G$
$= \Sigma(1,2,4,5,7)$

$F.G$
$= \Pi(0,2,3,4,5,6)$

3. For each of the two outputs in the logic diagram below:



a. The circuit is 4 -level logic (how many logic levels)
Note: consider the critical path and take an inverter as a level)

b. The logical expression obtained directly from the logic diagram (without any further manipulation) will be in the following form (select one answer):
- A standard form
- A canonical form
- A non-standard form

4. $F(x,y,z) = \bar{x}\bar{z} + y\bar{z}(\bar{x}+y)$

a. As given, F is not in a 2-level standard form

b.

	x	y	z	$\bar{x}\bar{z}$ *	$y\bar{z}$	$\bar{x}$	$\bar{x}+y$	$y\bar{z}\cdot(\bar{x}+y)$ *	F
0	0	0	0	1	0	1	1	0	1
1	0	0	1	0	0	1	1	0	0
2	0	1	0	1	1	1	1	1	1
3	0	1	1	0	0	1	1	0	0
4	1	0	0	0	0	0	0	0	0
5	1	0	1	0	0	0	0	0	0
6	1	1	0	0	1	0	1	1	1
7	1	1	1	0	0	0	1	0	0

c. c.1 $F = \sum(0,2,6)$

c.2 $= \prod(1,3,4,5,7)$

d. $F(x,y,z) = M_1 \cdot M_3 \cdot M_4 \cdot M_5 \cdot M_7$

$= M_{001} \cdot M_{011} \cdot M_{100} \cdot M_{101} \cdot M_{111}$

$= (x+y+\bar{z}) \cdot (x+\bar{y}+\bar{z}) \cdot (\bar{x}+y+z)$
$\cdot (\bar{x}+y+\bar{z}) \cdot (\bar{x}+\bar{y}+\bar{z})$

e. $F = \bar{x}\bar{z}(y+\bar{y}) + \bar{x}y\bar{z} + \underbrace{y\bar{z}}$

$= \bar{x}y\bar{z} + \bar{x}\bar{y}\bar{z} + \cancel{\bar{x}y\bar{z}} + xy\bar{z} + \cancel{\bar{x}y\bar{z}}$

$= \underset{010}{\bar{x}y\bar{z}} + \underset{110}{xy\bar{z}} + \underset{000}{\bar{x}\bar{y}\bar{z}} = \sum(0,2,6)$ ✓ same as in c.1

5. $F(A,B,C) = A\bar{C} + \bar{B}C$

a.

$$= (A\bar{C} + \bar{B})(A\bar{C} + C)$$
$$= (\bar{B} + A\bar{C})(C + A\bar{C})$$
$$= (\bar{B} + A)(\bar{B} + \bar{C})(C + A)\underbrace{(C + \bar{C})}_{=1}$$
$$= (C\bar{C} + A + \bar{B})(A\bar{A} + \bar{B} + \bar{C})(B\bar{B} + A + C)$$
$$= (A + \bar{B} + C)(A + \bar{B} + \bar{C})$$
$$\cancel{(A + \bar{B} + \bar{C})}(\bar{A} + \bar{B} + \bar{C}) \quad \text{(Repeated)}$$
$$(A + B + C)\cancel{(A + \bar{B} + C)} \quad \text{(Repeated)}$$
$$= (A + \bar{B} + C)(A + \bar{B} + \bar{C})(\bar{A} + \bar{B} + \bar{C})(A + B + C)$$
$$= M_{010} \cdot M_{011} \cdot M_{111} \cdot M_{000}$$
$$= \Pi(0,2,3,7)$$

b.

	A	B	C	$A\bar{C}$	$\bar{B}C$	F
0	0	0	0			0
1	0	0	1		1	1
2	0	1	0			0
3	0	1	1			0
4	1	0	0	1		1
5	1	0	1		1	1
6	1	1	0	1		1
7	1	1	1			0

From the truth Table
$F = \Pi(0,2,3,7)$ ✓

Same result obtained in (a) above.

6. For $F(w,x,y,z)$

a. $\underset{0}{w} + \underset{1}{\bar{x}} + \underset{1}{\bar{y}} + \underset{0}{z} = M_{0110} = M_6$

b. $\underset{0}{\bar{w}}\,\underset{0}{\bar{x}}\,\underset{1}{y}\,\underset{0}{\bar{z}} = m_{0010} = m_2$

c. $M_{12} = M_{1100} = \bar{w} + \bar{x} + y + z$

6, contd. (w, x, y, z)

d. $\bar{X}\bar{Y} = \sum$ 4 minterms $= W\bar{X}\bar{Y}X + W\bar{X}\bar{Y}\bar{X} + \bar{W}\bar{X}\bar{Y}X + \bar{W}\bar{X}\bar{Y}\bar{X}$

fixed

$W\bar{X}\bar{Y}X$
$W\bar{X}\bar{Y}\bar{X}$
$\bar{W}\bar{X}\bar{Y}X$
$\bar{W}\bar{X}\bar{Y}\bar{X}$

missing 2 variables

take all possible combinations

7 $F_1(A,B,C) = AB + \bar{A}\bar{B}$

$= ABC + AB\bar{C} + \bar{A}\bar{B}C + \bar{A}\bar{B}\bar{C}$

$= m_{111} + m_{110} + m_{001} + m_{000}$

$= \sum(0,1,6,7)$ —— (1)

$F_2(A,B,C) = \prod(2,3,4,7) = \sum(0,1,5,6)$ —— (2)

From (1) & (2) F_1 & F_2 are Not logically equivalent.