4.1

(a) $T_1 = B'C$, $T_2 = A'B$, $T_3 = A + T_1 = A + B'C$,

$T_4 = D \oplus T_2 = D \oplus (A'B) = A'BD' + D(A + B') = A'BD' + AD + B'D$

$F_1 = T_3 + T_4 = A + B'C + A'BD' + AD + B'D$

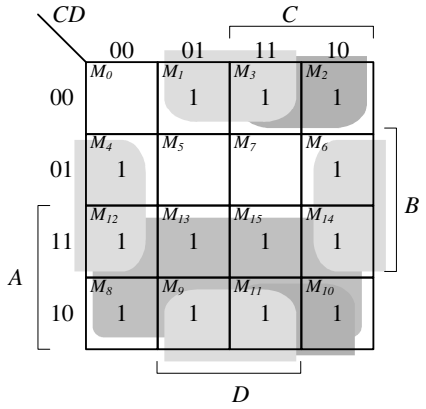
With $A + AD = A$ and $A + A'BD' = A + BD'$:

$F_1 = A + B'C + BD' + B'D$

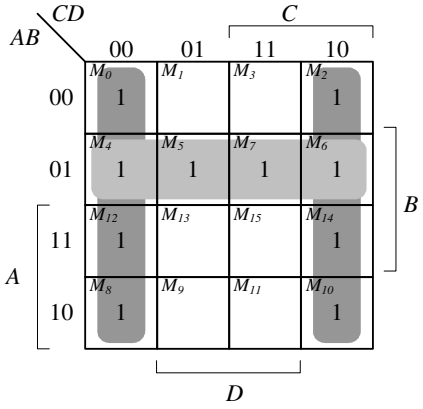
Alternative cover: $F_1 = A + CD' + BD' + B'D$

$F_2 = T_2 + D' = A'B + D'$

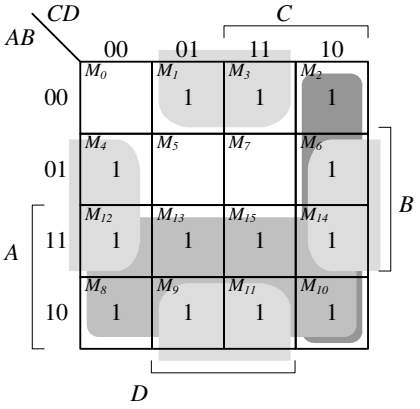
$ABCD$	T_1	T_2	T_3	T_4	F_1	F_2
0000	0	0	0	0	0	1
0001	0	0	0	1	1	0
0010	1	0	1	0	1	1
0011	1	0	1	1	1	0
0100	0	1	0	1	1	1
0101	0	1	0	0	0	1
0110	0	1	0	1	1	1
0111	0	1	0	0	0	1
1000	0	0	1	0	1	1
1001	0	0	1	1	1	0
1010	1	0	1	0	1	1
1011	1	0	1	1	1	0
1100	0	0	1	0	1	1
1101	0	0	1	1	1	0
1110	0	0	1	0	1	1
1111	0	0	1	1	1	0



$F_1 = A + B'C + B'D + BD'$



$F_2 = A'B + D'$



$F_1 = A + CD' + B'D + BD'$

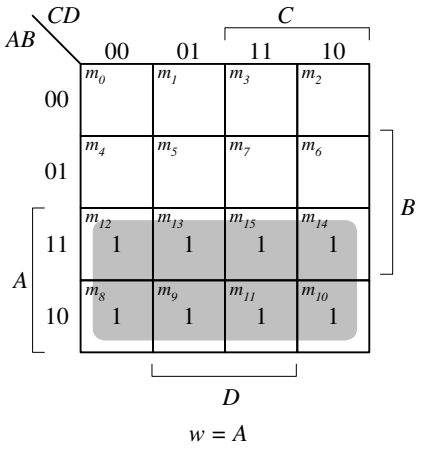
4.2

$$F(A, B, C, D) = ((A'D)'(A' + BC))' = A'D + (A' + BC)'$$
$$= A'D + A(BC)'$$
$$= A'D + AB' + AC'$$

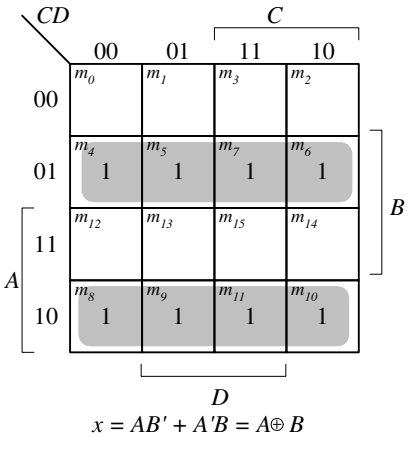
$$G(A, B, C, D) = ((A'D)(A' + BC))' = (A'D)' + (A' + BC)'$$
$$= (A + D') + A(BC)' = A + D' + AB' + AC'$$
$$= A(1 + B' + C') + D'$$
$$= A + D'$$

4.7 **(a)**

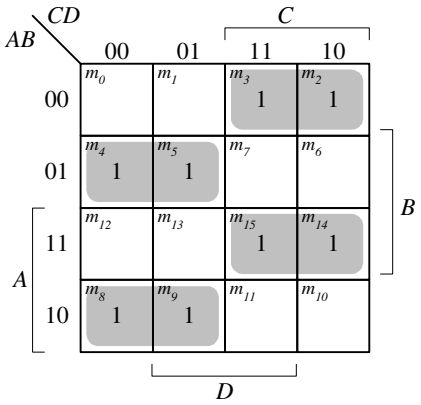
ABCD	*wxyz*
0000	0000
0001	0001
0011	0010
0010	0011
0110	0100
0111	0101
0101	0110
0100	0111
1100	1000
1101	1001
1111	1010
1110	1011
1010	1100
1011	1101
1001	1110
1000	1111



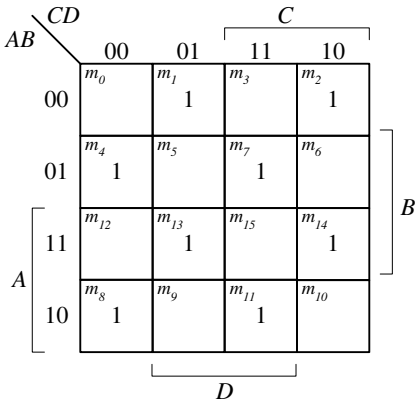
$w = A$



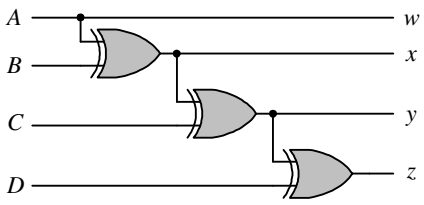
$x = AB' + A'B = A \oplus B$



$y = A'B'C\ A'BC' + ABC + AB'C'$
$= A'(A \oplus B) + A(B \oplus C)'$
$= A \oplus B \oplus C$
$= X \oplus C$



$z = A \oplus B \oplus C \oplus D$
$= y \oplus D$



4.13

	Sum	*C*	*V*
(a)	1101	0	1
(b)	0001	1	1
(c)	0100	1	0
(d)	1011	0	1
(e)	1111	0	0

4.17 **(a)** $(C'_iG'_i + P'_i)' = (C_i + G_i)P_i = G_iP_i + P_iC_i = A_iB_i(A_i + B_i) + P_iC_i$

$= A_iB_i + P_iC_i = G_i + P_iC_i$

$= A_iB_i + (A_i + B_i)C_i = A_iB_i + A_iC_i + B_iC_i = C_{i+1}$

$(P_iG'_i)\oplus C_i = (A_i + B_i)(A_iB_i)'\oplus C_i = (A_i + B_i)(A'_i + B'_i)\oplus C_i$

$= (A'_iB_i + A_iB'_i)\oplus C_i = A_i\oplus B_i\oplus C_i = S_i$

(b) Output of NOR gate = $(A_0 + B_0)' = P'_0$

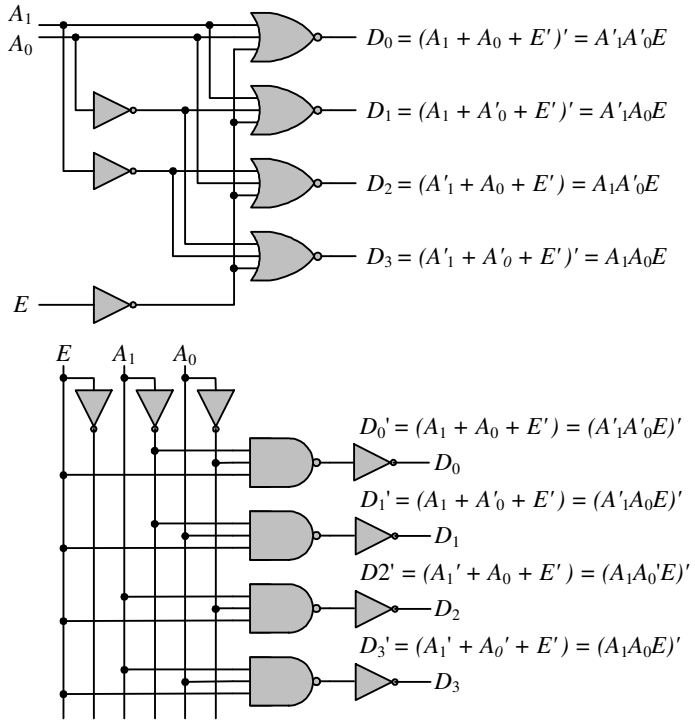
Output of NAND gate = $(A_0B_0)' = G'_0$

$S_0 = (P_0G'_0)\oplus C_0$

$C_1 = (C'_0G'_0 + P'_0)'$ as defined in part (a)

4.23

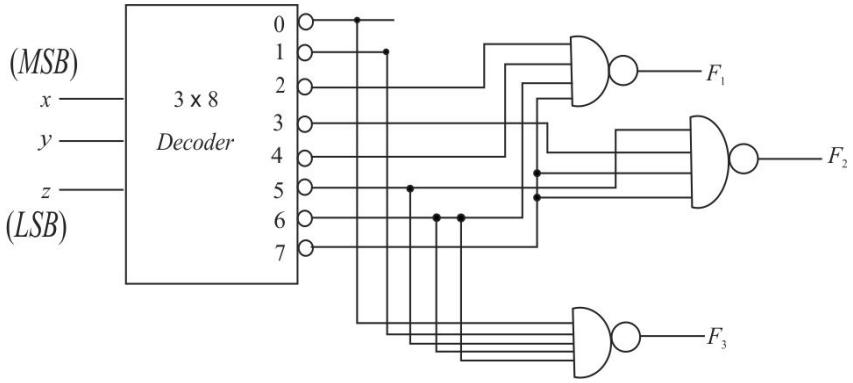
D0 = A1'A0' = (A1 + A0)'	(NOR)	D0' = (A1'A0')'	(NAND)
D1 = A1'A0 = (A1 + A0')'	(NOR)	D1' = (A1'A0)'	(NAND)
D2 = A1A0' = (A1' + A0)'	(NOR)	D2' = (A1A0')'	(NAND)
D3 = A1A0 = (A1' + A0)'	(NOR)	D0' = (A1A0)'	(NAND)



4.28 **(a)** $F_1 = xy + xz' + yz' = \Sigma(2, 4, 6, 7)$

$F_2 = xz + xy + yz = \Sigma(3, 5, 6, 7)$

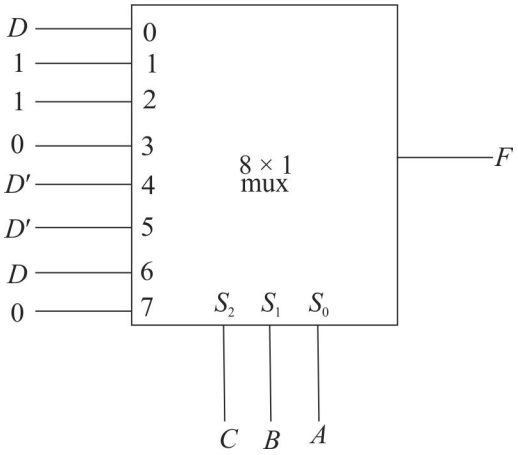
$F_3 = y'z + x'y'z' + xy = \Sigma(0, 1, 5, 6, 7)$



4.34

(b)

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
D'	0	1	1	0	1	1	0	0
D	1	1	1	0	0	0	1	0
	D	1	1	0	D'	D'	D	0



$F = \Sigma(1, 2, 4, 5, 8, 9, 10, 14)$

4.35

(b) F = S(1, 2, 5, 7, 8, 10, 11, 13, 15)

Inputs ABCD	$F_2 = \Sigma(1, 2, 5, 7, 8, 10, 11, 13, 15)$	
0000	0	
0001	1	$AB = 00$
0010	1	$F = C'D + CD'$
0011	0	
0100	0	
0101	1	$AB = 01$
0110	0	$F = C'D + CD = D$
0111	1	
1000	1	
1001	0	
1010	1	$AB = 10$
1011	1	$F = C'D' + C'D + CD = C'D' + D$
1100	0	
1101	1	$AB = 11$
1110	0	$F = D$
1111	1