

**3.13** (a)  $F = xz' + y'z' + yz' + xy' = \Sigma(0, 2, 4, 5, 6)$

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

$F = z' + xy'$  (Sum of Product)

$F = (x + z')(y' + z')$  (Product of Sum)

**3.15** (a)  $F(x, y, z) = \Sigma(0, 1, 3, 5, 7)$   
 $d = \Sigma(2, 4, 6)$

$x \backslash yz$		00	01	11	10
		0	1	1	0
0		1	1	1	-
1		-	1	1	-

$F = 1$

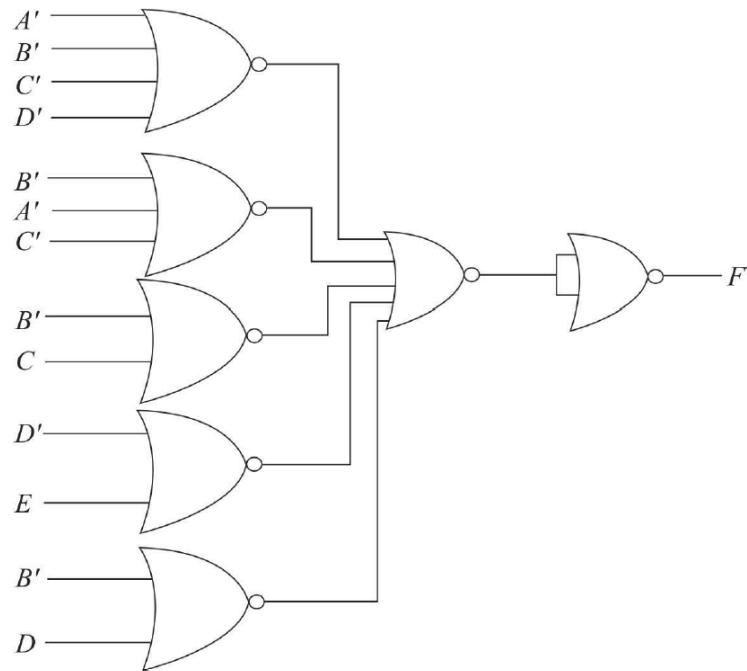
(b)  $F = \Sigma(0, 4, 8, 10, 14)$   
 $d = \Sigma(2, 6, 12)$

$AB \backslash CD$		00	01	11	10
		00	01	11	10
00		1	0	0	-
01		1	0	0	-
11		-	0	0	1
10		1	0	0	1

$F = D'$

3.20

$$\begin{aligned}
 F &= BC(D + C)A + (BC' + DE') + BD' \\
 &= ABCD + ABC + BC' + DE' + BD' \\
 &= [(A' + B' + C' + D')' + (A' + B' + C')' + (B' + C)' + (D' + E)' + (B' + D)]']'
 \end{aligned}$$



3.24

$$F(A, B, C, D) = \Sigma(1, 5, 8, 9, 10, 11, 12, 13, 15)$$

		CD			
		00	01	11	10
AB	00	0	1	0	0
	01	0	1	0	0
	11	1	1	1	0
	10	1	1	1	1

Annotations:  $C'D$  points to the cell (00, 01);  $AD$  points to the cell (11, 11);  $AB'$  points to the cell (10, 11);  $AC'$  points to the cell (00, 11).

$$\begin{aligned}
 F(A, B, C, D) &= C'D + AB' + AC' + AD \\
 &= ((C'D)'(AB')'(AC')'(AD))' && \rightarrow \text{(a) AND-OR} \\
 &= ((C+D')(A'+B)(A'+C)(A'+D))' && \rightarrow \text{(b) OR-NAND} \\
 &= ((C + D)' + (A' + B)' + (A' + C)' + (A' + D)')' && \rightarrow \text{(c) NOR-OR} \\
 &= ((C'D)'(AB')'(AC')'(AD))' && \rightarrow \text{(d) NAND-NAND}
 \end{aligned}$$

		CD			
		00	01	11	10
AB	00	0	1	0	0
	01	0	1	0	0
	11	1	1	1	0
	10	1	1	1	1

Annotations:  $(A+C')$  points to the cell (00, 00);  $(A+D)$  points to the cell (01, 00);  $(B'+C'+D)$  points to the cell (11, 10).

$$\begin{aligned}
 F(A, B, C, D) &= (A + D)(A + C')(B' + C' + D) && \rightarrow \text{(e) OR-AND} \\
 &= ((A + D)' + (A + C')' + (B' + C' + D)')' && \rightarrow \text{(f) NOR-NOR} \\
 &= (A'D)'(A'C)'(BCD)' && \rightarrow \text{(g) NAND-AND}
 \end{aligned}$$

3.26

$$f = abc' + b'd' + a'd' + b'cd'$$

$ab \backslash cd$	00	01	11	10
00	1	0	0	1
01	1	0	0	1
11	1	1	0	
10	1	0	0	1

$$g = (a + b + c' + d')(a' + b' + d)(a' + d')$$

$ab \backslash cd$	00	01	11	10
00	1	1	0	1
01	1	1	1	1
11	0	0	0	0
10	1	0	0	1

Group the overlapping is

$$F = fg = \Sigma(0, 2, 4, 5, 8, 10)$$

$ab \backslash cd$	00	01	11	10
00	1	0	0	1
01	1	0	0	1
11	0	0	0	0
10	1	0	0	1

$$F = a'd' + b'd'$$