

## 第二章布置习题参考解

2-1 用真值表验证  $XYZ = \overline{X+Y+Z}$  三变量 DeMorgan 定律

$X$	$Y$	$Z$	$XYZ$	$\overline{XYZ}$	$\overline{X+Y+Z}$
0	0	0	0	1	1
0	0	1	0	1	1
0	1	0	0	1	1
0	1	1	0	1	1
1	0	0	0	1	1
1	0	1	0	1	1
1	1	0	0	1	1
1	1	1	1	0	0

2-2 用代数化简来证明下列布尔议程的性质

a)  $\overline{X}\overline{Y} + \overline{X}Y + XY = \overline{X} + Y$

$$\begin{aligned}
 \overline{X}\overline{Y} + \overline{X}Y + XY &= (\overline{X}\overline{Y} + \overline{X}Y) + (\overline{X}Y + XY) \\
 &= \overline{X}(\overline{Y} + Y) + Y(\overline{X} + X) \\
 &= \overline{X} + Y
 \end{aligned}$$

c)  $Y + \overline{X}Z + X\overline{Y} = X + Y + Z$

$$\begin{aligned}
 Y + \overline{X}Z + X\overline{Y} &= Y + X\overline{Y} + \overline{X}Z \\
 &= (Y + X)(Y + \overline{Y}) + \overline{X}Z \\
 &= Y + X + \overline{X}Z \\
 &= Y + (X + \overline{X})(X + Z) \\
 &= X + Y + Z
 \end{aligned}$$

## 2-3 用代数化简来证明下列布尔议程的性质

$$a) \quad A\overline{B}\overline{C} + B\overline{C}\overline{D} + BC + \overline{C}D = B + \overline{C}D$$

$$\begin{aligned} & A\overline{B}\overline{C} + B\overline{C}\overline{D} + BC + \overline{C}D \\ &= A\overline{B}\overline{C} + B\overline{C}\overline{D} + ABC + \overline{A}BC + (\overline{C}D + B\overline{C}D) \\ &= AB + ABC + B\overline{C}(\overline{D} + D) + ABC + \overline{A}BC + \overline{C}D \\ &= AB + B\overline{C} + BC + \overline{C}D \\ &= AB + B + \overline{C}D \\ &= B + \overline{C}D \end{aligned}$$

$$c) \quad A\overline{D} + \overline{A}\overline{B} + \overline{C}D + \overline{B}C = (\overline{A} + \overline{B} + \overline{C} + \overline{D})(A + B + C + D)$$

$$\begin{aligned} & A\overline{D} + \overline{A}\overline{B} + \overline{C}D + \overline{B}C \\ &= \overline{\overline{A\overline{D} + \overline{A}\overline{B} + \overline{C}D + \overline{B}C}} \\ &= \overline{(\overline{A} + D)(C + \overline{D})(A + \overline{B})\overline{B}C} \\ &= \overline{(\overline{A}C + \overline{A}\overline{D} + CD)(B + \overline{C})(A + \overline{B})} \\ &= \overline{(\overline{A}BC + \overline{A}BD + BCD + \overline{A}C\overline{D})(A + \overline{B})} \\ &= \overline{ABCD + \overline{A}BCD} \\ &= (\overline{A} + \overline{B} + \overline{C} + \overline{D})(A + B + C + D) \end{aligned}$$

## 2-6 化简下列布尔表达式，使表达式中包含的变量最少

$$\begin{aligned} b) \quad & (A + B + C) \bullet \overline{ABC} \\ &= A \bullet \overline{ABC} + B \bullet \overline{ABC} + C \bullet \overline{ABC} \\ &= A(\overline{B} + \overline{C}) + B(\overline{A} + \overline{C}) + C(\overline{A} + \overline{B}) \\ &= A\overline{B} + A\overline{C} + B\overline{A} + B\overline{C} + C\overline{A} + \overline{B}C \\ &= A\overline{B} + \overline{A}C + \overline{B}C + A\overline{C} + \overline{A}B + \overline{B}C \\ &= A\overline{B} + \overline{A}C + A\overline{C} + \overline{A}B \\ &= A(\overline{B} + \overline{C}) + \overline{A}(C + B) \\ &= \overline{\overline{A\overline{B} + \overline{A}C}} + \overline{\overline{A\overline{B} + \overline{A}C}} \end{aligned}$$

$$\begin{aligned} d) \quad & \overline{A}\overline{B}D + \overline{A}\overline{C}D + BD = D(\overline{A}\overline{B} + B) + \overline{A}\overline{C}D \\ &= \overline{A}D + DB + \overline{A}\overline{C}D = \overline{A}D(1 + \overline{C}) + DB \\ &= \overline{A}D + DB = D(\overline{A} + B) \end{aligned}$$

## 2-10

a)  $(XY + Z)(Y + XZ)$

XYZ	F
000	0
001	0
010	0
011	1
100	0
101	1
110	1
111	1

$$\begin{aligned}
 F &= (XY + Z)(Y + XZ) \\
 &= (X + Z)(Y + Z)(Y + X)(Y + Z) \\
 &= (X + Z) + Y\bar{Y})(Y + Z + X\bar{X})(Y + X + Z\bar{Z}) \\
 &= (X + Y + Z)(X + Z + \bar{Y})(Y + Z + X) \\
 &\quad (Y + Z + \bar{X})(Y + X + Z)(Y + X + \bar{Z}) \\
 &= (X + Y + Z)(X + \bar{Y} + Z)(\bar{X} + Y + Z)(X + Y + \bar{Z}) \\
 &= \bar{X}YZ + X\bar{Y}Z + XY\bar{Z} + XYZ
 \end{aligned}$$

c)

XYZ	F
0000	0
0001	0
0010	1
0011	0
0100	0
0101	0
0110	1
0111	0
1000	0
1001	0
1010	1
1011	0
1100	1
1101	1
1110	1
1111	1

$$\begin{aligned}
 &\bar{W}\bar{X}Y\bar{Z} + \bar{W}XY\bar{Z} + W\bar{X}Y\bar{Z} + WX\bar{Y}\bar{Z} + WX\bar{Y}Z + WXYZ \\
 &\quad + WXYZ \\
 &(W + X + Y + Z)(W + X + Y + \bar{Z})(W + X + \bar{Y} + \bar{Z}) \\
 &(W + \bar{X} + Y + Z)(W + \bar{X} + Y + \bar{Z})(W + \bar{X} + \bar{Y} + \bar{Z}) \\
 &(\bar{W} + X + Y + Z)(\bar{W} + X + Y + \bar{Z})(\bar{W} + X + \bar{Y} + \bar{Z})
 \end{aligned}$$

## 2-11

a)  $E = \sum m(1,2,4,6) = \prod M(0,3,5,7)$   $F = \sum m(0,2,4,7) = \prod M(1,3,5,6)$

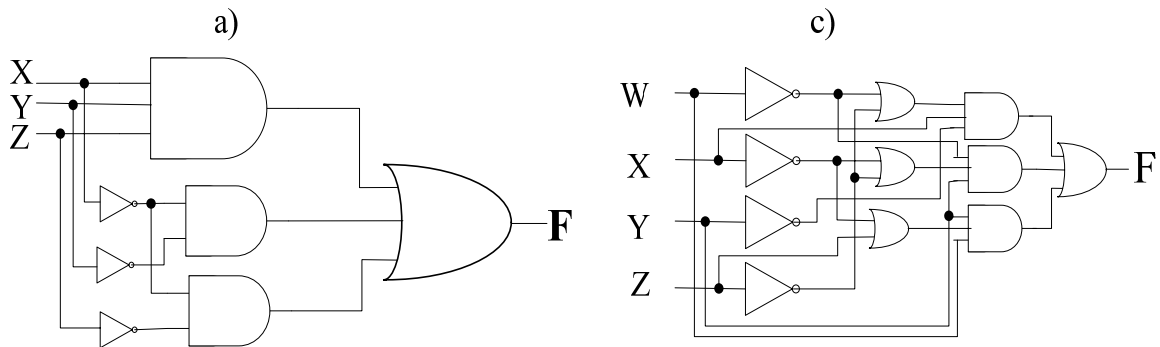
c)  $E + F = \sum m(0,1,2,4,6,7)$   $E \bullet F = \sum m(2,4)$

a)  $E = \bar{X}\bar{Y}Z + \bar{X}Y\bar{Z} + X\bar{Y}\bar{Z} + XYZ$   $F = \bar{X}\bar{Y}\bar{Z} + \bar{X}Y\bar{Z} + X\bar{Y}\bar{Z} + XYZ$   
 $= \bar{X}\bar{Y}Z + X\bar{Z} + Y\bar{Z}$   $= \bar{Y}\bar{Z} + \bar{X}\bar{Z} + XYZ$

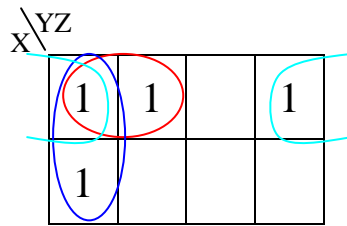
2-12

$$\begin{aligned}
 \text{b)} \quad & \bar{X} + X(X + \bar{Y})(Y + \bar{Z}) = (\bar{X} + X)(\bar{X} + (X + \bar{Y})(Y + \bar{Z})) \\
 & = (\bar{X} + X + \bar{Y})(\bar{X} + Y + \bar{Z}) \quad \text{p.o.s.} \\
 & = (1 + \bar{Y})(\bar{X} + Y + \bar{Z}) = \bar{X} + Y + \bar{Z} \quad \text{s.o.p.}
 \end{aligned}$$

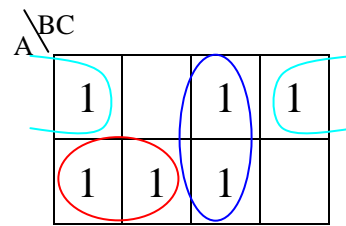
2-13



2-14

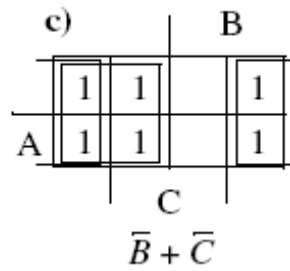
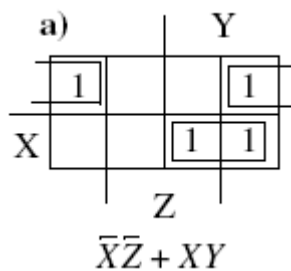


a)  $F = \bar{Y}\bar{Z} + \bar{X}\bar{Z} + \bar{X}\bar{Y}$

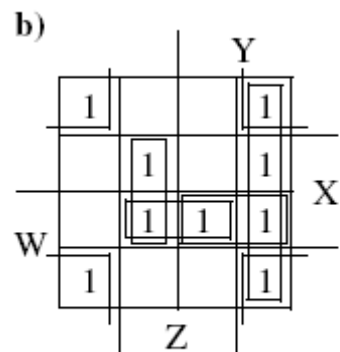


b)  $F = \bar{A}\bar{C} + \bar{A}\bar{B} + BC$

2-15

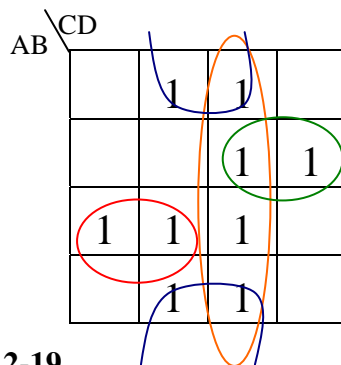


2-16



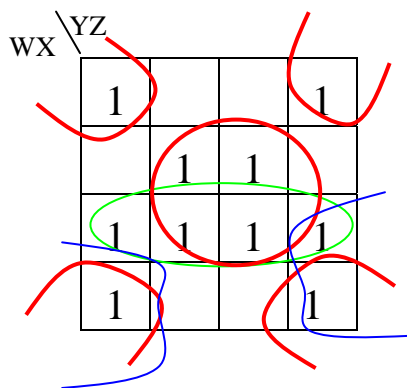
$$Y\bar{Z} + \bar{X}\bar{Z} + X\bar{Y}Z + (WXZ \text{ or } WXY)$$

2-17



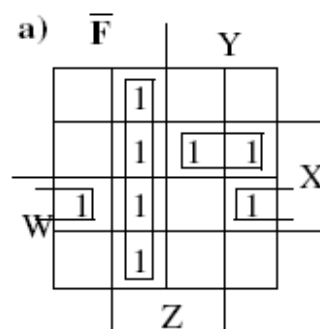
b)  $F = \bar{B}D + CD + ABC\bar{C} + \bar{A}BC$

2-19



a) Prime =  $WX + XZ + \bar{X}\bar{Z} + W\bar{Z}$

Essential =  $XZ, \bar{X}\bar{Z}$



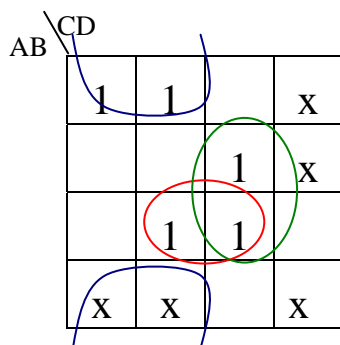
2-21

$$\bar{F} = \Sigma m(1, 5, 6, 7, 9, 12, 13, 14)$$

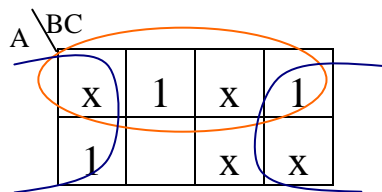
$$F = \bar{Y}Z + WX\bar{Z} + \bar{W}XY$$

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

2-24



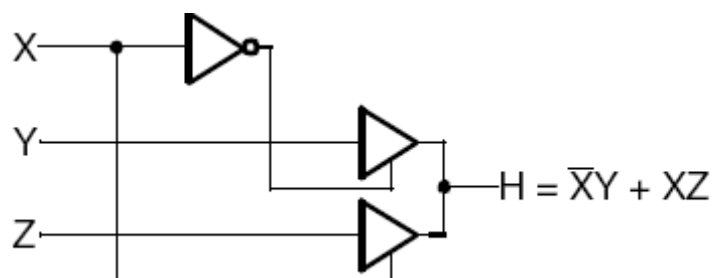
a)  $F = \overline{B}\overline{C} + ABD + BCD$



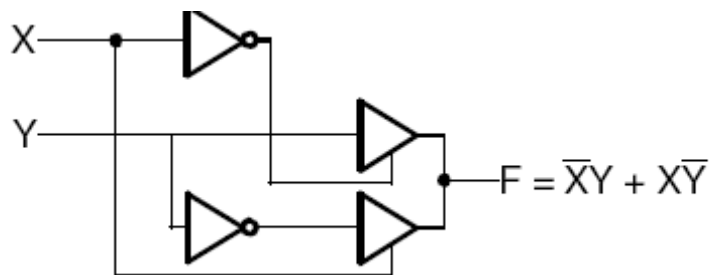
c)  $F = A + \overline{C}$

2-34

(a) 用两个三态缓冲器和一个非门实现函数  $H = \overline{X}Y + XZ$ 。

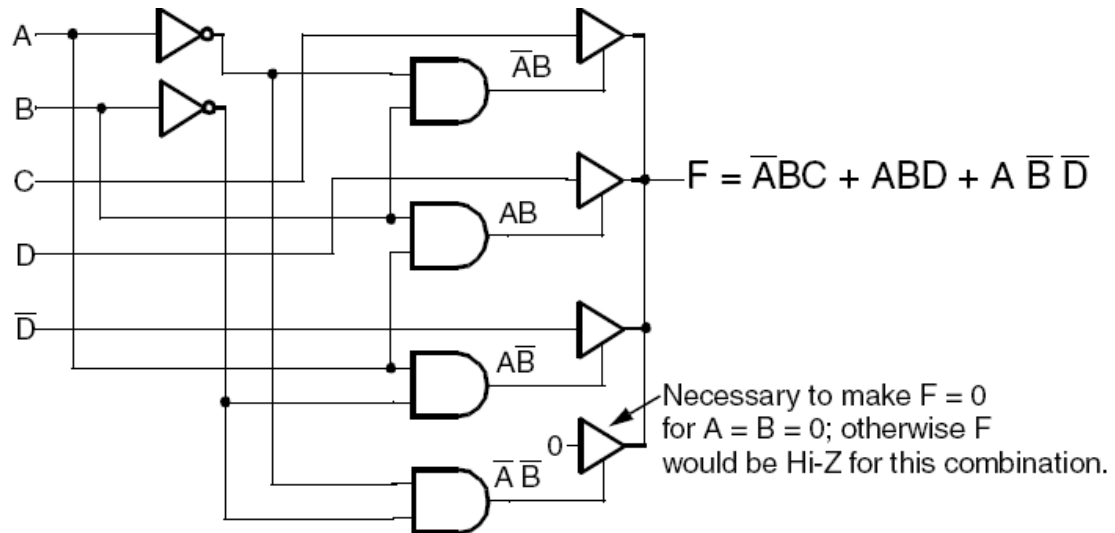


(b) 把两个缓冲器和两个非门互联实现异或门。



## 2-35

(a) 把三个三态缓冲器的输出连在一起，增加一些逻辑（门）实现函数  $F = \overline{A}BC + ABD + A\overline{B}\overline{D}$ 。假设 C、D 以及  $\overline{D}$  是三态缓冲器的输入，A、B 通过逻辑电路产生使能输入。



(b) 对于(a) 中设计的三态缓冲器的输出是不是没有冲突？如果不是，更改必要的设计，使设计的电路没有冲突。

上述设计没有三态输出冲突。