数字电路 第四章

6.(a) $F = W\cdot X\cdot Y\cdot Z\cdot(W\cdot X\cdot Y'\cdot Z' + WX'YZ + W'XYZ + WXY'Z)$

$= WXYZ\cdot WXYZ' + WXYZ\cdot WX'YZ + WXYZ\cdot W'XYZ + WXYZ\cdot WXY'Z$

$= WXY\cdot 0 + WYZ\cdot 0 + XYZ\cdot 0 + WXZ\cdot 0$

$= 0 + 0 + 0 + 0$

$= 0$

7.(b)

W	X	Y	Z	W'X	Y'Z'	X'Z	F
0	0	0	0	0	1	0	1
0	0	0	1	0	0	1	1
0	0	1	0	0	0	0	0
0	0	1	1	0	0	1	1
0	1	0	0	1	1	0	1
0	1	0	1	1	0	0	1
0	1	1	0	1	0	0	1
0	1	1	1	1	0	0	1
1	0	0	0	0	1	0	1
1	0	0	1	0	0	1	1
1	0	1	0	0	0	0	0
1	0	1	1	0	0	1	1
1	1	0	0	0	1	0	1
1	1	0	1	0	0	0	0
1	1	1	0	0	0	0	0
1	1	1	1	0	0	0	0

7.(f)

A	B	C	D	E	A'+B'·C·D	B'+C'+D·E	F
0	0	0	0	0	1	1	1
0	0	0	0	1	1	1	1
0	0	0	1	0	1	1	1
0	0	0	1	1	1	1	1
0	0	1	0	0	1	1	1
0	0	1	0	1	1	1	1
0	0	1	1	0	1	1	1
0	0	1	1	1	1	1	1
0	1	0	0	0	1	1	1
0	1	0	0	1	1	1	1
0	1	0	1	0	1	1	1
0	1	0	1	1	1	1	1
0	1	1	0	0	1	1	1
0	1	1	0	1	1	1	1
0	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1
1	0	0	0	0	1	1	1
1	0	0	0	1	1	1	1
1	0	0	1	0	1	1	1
1	0	0	1	1	1	1	1
1	0	1	0	0	1	1	1
1	0	1	0	1	1	1	1
1	0	1	1	0	1	1	1
1	0	1	1	1	1	1	1
1	1	0	0	0	1	1	1
1	1	0	0	1	1	1	1
1	1	0	1	0	1	1	1
1	1	0	1	1	1	1	1
1	1	1	0	0	1	1	1
1	1	1	0	1	1	1	1
1	1	1	1	0	1	1	1
1	1	1	1	1	1	1	1

10. (c) $F = \sum_{A,B,C,D}(1,2,5,6) = \prod_{A,B,C,D}(0,3,4,7,8,9,10,11,12,13,14,15)$

$\therefore \sum_{A,B,C,D}(1,2,5,6) = A'B'C'D + A'B'CD' + A'BC'D + A'BCD'$

$\prod_{A,B,C,D}(0,3,4,7,8,9,10,11,12,13,14,15) = (A'+B'+C'+D')\cdot(A'+B'+C+D)\cdot(A'+B+C'+D')\cdot(A'+B+C+D)\cdot(A+B'+C'+D')\cdot(A+B'+C'+D)\cdot(A+B'+C+D')\cdot(A+B'+C+D)\cdot(A+B+C'+D')\cdot(A+B+C'+D)\cdot(A+B+C+D')\cdot(A+B+C+D)$

10. (f) ∵

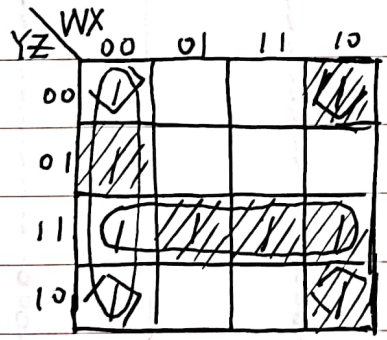
A	B	C	A'B	B'C	F
0	0	0	0	0	0
0	0	1	0	1	1
0	1	0	1	0	1
0	1	1	1	0	1
1	0	0	0	0	1
1	0	1	0	1	1
1	1	0	0	0	1
1	1	1	0	0	1

$\therefore F = \sum_{A,B,C}(1,2,3,4,5,6,7) = \prod_{A,B,C}(0)$

$\therefore \sum_{A,B,C}(1,2,3,4,5,6,7) = A'B'C + A'BC' + A'BC + AB'C' + AB'C + ABC' + ABC$

$\prod_{A,B,C}(0) = A' + B' + C'$

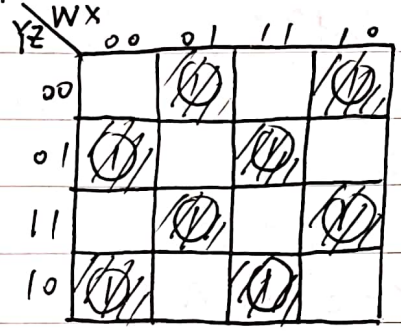
15. (d) $F = \sum_{W,X,Y,Z}(0,1,2,3,7,8,10,14,15)$



$\therefore F = WX + YZ + X'Z'$

阴影部分为奇异1单元

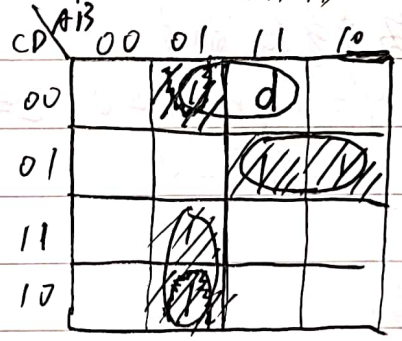
15. (e) $F = \sum_{W,X,Y,Z}(1,2,4,7,8,11,13,14)$



$\therefore F = W'X'Y'Z + W'X'YZ' + W'XY'Z' + W'XYZ + WX'Y'Z' + WX'YZ + WXY'Z + WXYZ'$

阴影部分为奇异1单元

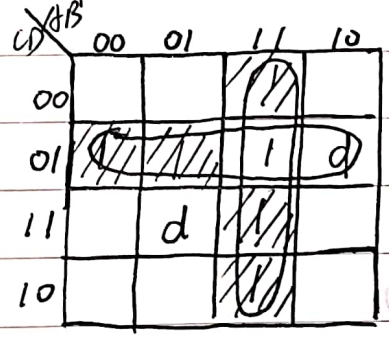
18. (c) $F = \sum_{A,B,C,D}(4,6,7,9,13) + d(12)$



$\therefore F = BC'D' + AC'D + ABC$

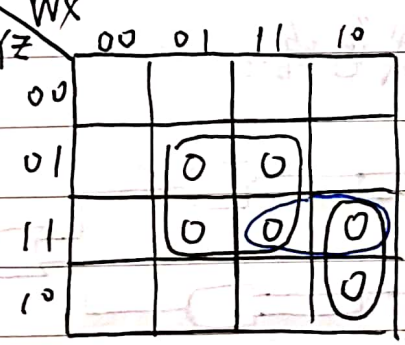
阴影部分为奇异1单元

18. (d) $F = \sum_{A,B,C,D}(1,5,12,13,14,15) + d(7,9)$



$\therefore F = AB + C'D$

19. (e) $F = (W' + X + Y') \cdot (X' + Z')$ $W=1$

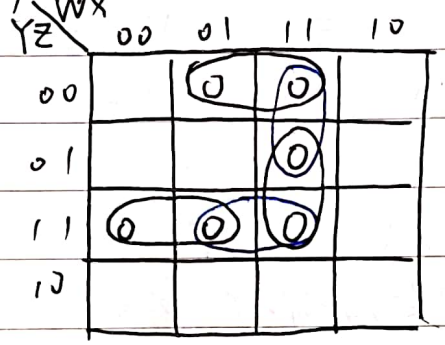


画色圈为静态冒险 $Y=1, Z=1$

$\therefore$ 无冒险电路

$F' = (W' + X + Y') \cdot (X' + Z') \cdot (W + Y + Z)$

19.f) $F=(W+Y'+Z')\cdot(W'+X'+Z')\cdot(X'+Y+Z)$

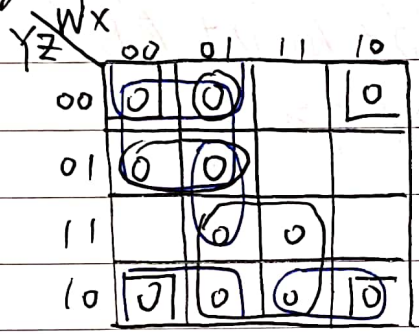


蓝色圈为静态冒险：X=1, Y=1, Z=1
和 W=1, X=1, Y=0.

∴无冒险电路：

$F'=(W+Y+Z')\cdot(W'+X'+Z')\cdot(X'+Y+Z)$
$\cdot(X'+Y'+Z')\cdot(W'+X'+Y)$

19.(g) $F=(W+Y+Z')\cdot(W+X'+Y+Z)\cdot(X'+Y')(X+Z)$



蓝色圈内为静态冒险：
有 W=0, Y=0 和 W=0, Z=0
和 W=1, Y=1, Z=0

∴无冒险电路为：

$F'=(W+Y+Z')\cdot(W+X'+Y+Z)(X'+Y')\cdot(X+Z)$
$\cdot(W+Y)\cdot(W+Z)\cdot(W'+Y'+Z)\cdot(W+X'+Z')$

24.证明：$(X+Y)(X'+Z)$

$=XX'+XZ+X'Y+YZ$

$=0+XZ+X'Y+YZ$

$=XZ+X'Y$ （由T11）

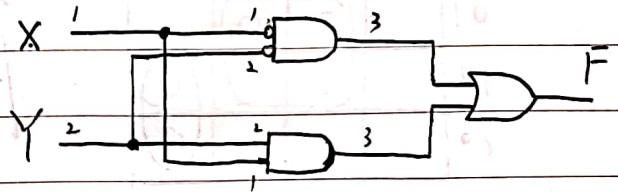
36.解：

X	Y	F
0	0	1
0	1	0
1	0	0
1	1	1

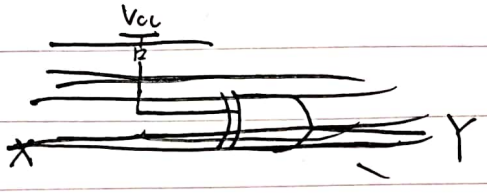
由真值表：

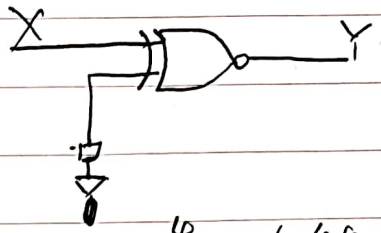
$\therefore F=X'Y'+XY$

“与-或”电路：



38. 用一个2输入 XNOR 即可，一端接输入，一端接地





45. X Y Z　对于4种输入：$2^4=16$种

0 0 0

0 0 1

0 1 0

0 1 1

1 0 0

1 0 1

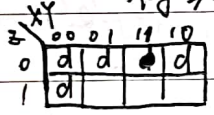
1 1 0

1 1 1

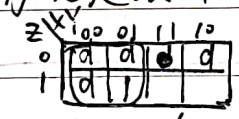
∴共16种不同的3变量逻辑函数 $F(X,Y,Z)$

对 XYZ = 000, 001, 010, 100, 111 的情况，

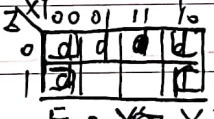
将其视为无关项，然后画出16个函数的卡诺图



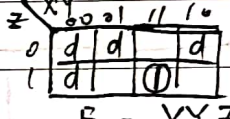
$F_1=0$



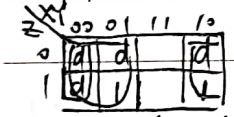
$F_2=X'$



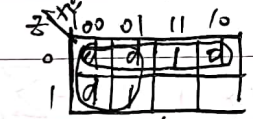
$F_3=Y'$



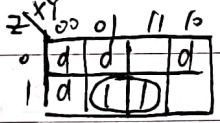
$F_4=XYZ$



$F_5=X'+Y'$

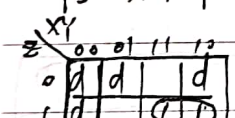


$F_6=X'+Z'$

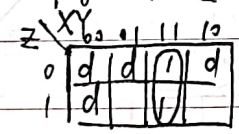


$F_7=YZ$

$F_8=Y'+Z'$

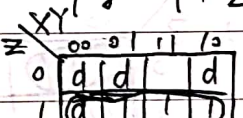


$F_9=XZ$



$F_{10}=XY$

$F_{11}=X'+Y'+Z'$

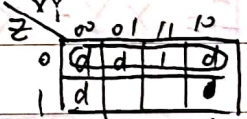


$F_{12}=Z$

$F_{13}=Y$

$F_{14}=X$

$F_{15}=1$



$F_{16}=Z'$

46. 由T8：$X\cdot Y+X\cdot Z=X\cdot(Y+Z)$

再由对偶性：$(X+Y)\cdot(X+Z)=X+Y\cdot Z$

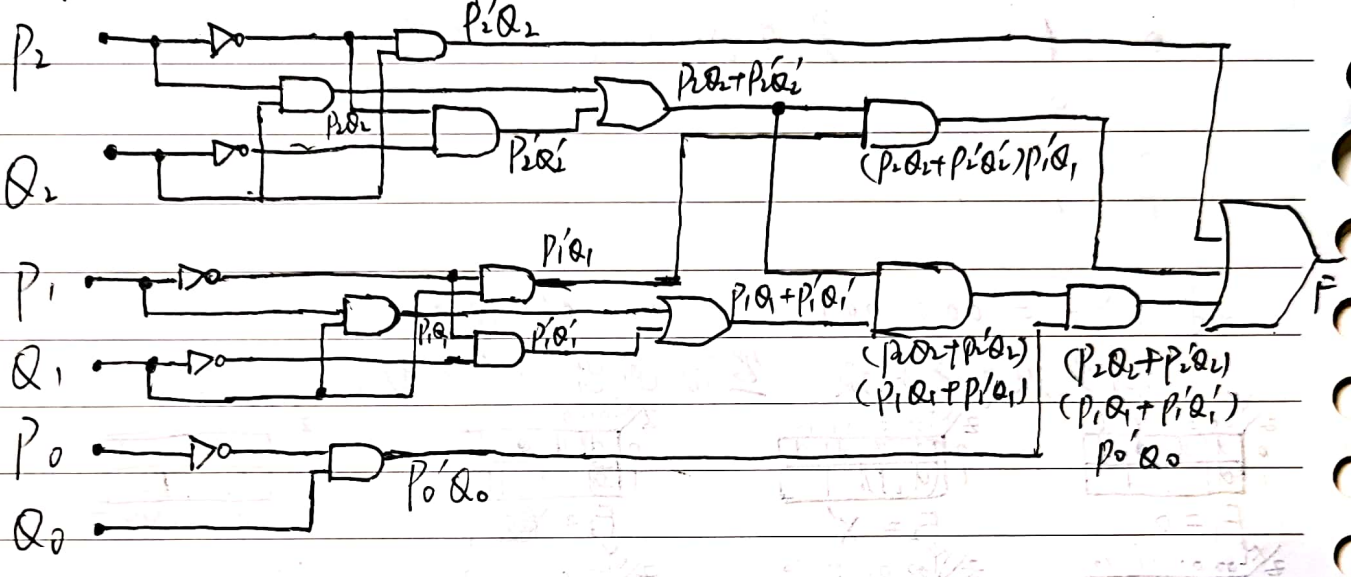
(+和·互换，即得到了T8'

计算次序不变)

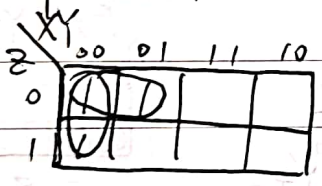
55.

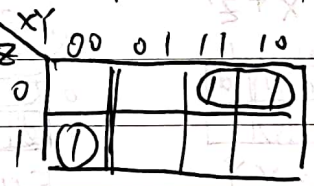
P_2Q_2	P_1Q_1	P_0Q_0	$P \bullet < Q$
0 1			1
任何00	0 1		1
11 任何00	11 或00	0 1	1

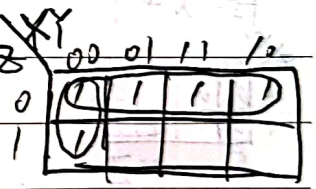
$\therefore F = P_2'Q_2 + (P_2Q_2 + P_2'Q_2') \cdot P_1'Q_1 + (P_2Q_2 + P_2'Q_2')(P_1Q_1 + P_1'Q_1')P_0'Q_0$



5b. $\because F = \sum_{X,Y,Z}(0,1,2)$, $G = \sum_{X,Y,Z}(1,4,6)$, $H = \sum_{X,Y,Z}(0,1,2,4,6)$

$\therefore$ F: 

G: 

H: 

$\therefore F = X'Y' + X'Z'$ $G = X \cdot Z' + X'Y'Z$ $H = Z' + X'Y'$

59. (c)

① VW XYZ

组别	数对次	~~A B C D~~	合法否
0	0	0 0 0 0 0	✓
1	1	0 0 0 0 1	✓
	2	0 0 0 1 0	✓
	4	0 0 1 0 0	✓
	8		
2	3	0 0 0 1 1	✓
	5	0 0 1 0 1	✓
	10	0 0 1 1 0	✓
	20	0 1 0 1 0	✓
	26	1 1 0 1 0	✓
3	11	0 1 0 1 1	✓
	14	0 1 1 1 0	✓
	21	1 0 1 0 1	✓
	25	1 1 0 0 1	✓
	28	1 1 0 1 0	✓
	28	1 1 1 0 0	✓

4	27	1 1 0 1 1	✓
	29	1 1 1 0 1	✓
	30	1 1 1 1 0	✓

②

组别	最小项组	VWXYZ	合并否
0	0,1	0000-	✓
	0,2	000-0	✓
	0,4	00-00	✓
1	1,3	000-1	✓
	1,5	00-01	✓
	2,3	0001-	✓
	2,10	0-010	✓
	4,5	0010-	✓
	4,20	-0100	✓
2	3,11	0-011	✓
	5,21	-0101	✓
	10,11	0101-	✓
	10,14	01-10	✓
	10,26	-1010	✓
	20,21	1010-	✓
	20,28	1-100	✓
	24,25	1100-	✓
	24,26	110-0	✓
	24,28	11-00	✓
3	11,27	-1011	✓
	14,30	-111 0	✓
	21,29	1-101	✓
	25,27	110-1	✓
	25,29	11-01	✓
	26,27	1101-	✓
	26,30	11-10	✓
	28,29	1110-	✓
	28,30	111-0	✓

组别	最小项组	VWXYZ	合并否
0	0,1,2,3	000--	PI1
	0,1,4,5	00●-0-	PI2
	0,1,2,3	00●--(x)	/
	0,1,4,5	00●-0-(x)	/
1	2,3,10,11	0-01-	PI3
	2,3,10,11	0-01-(x)	/
	4,5,20,21	-010-	PI4
	4,5,20,21	-010-(x)	/
2	10,11,26,27	-101-	PI5
	10,11,26,27	-101-(x)	/
	10,14,26,30	-1-10	PI6
	10,14,26,30	-1-10(x)	/
	20,21,28,29	1-10-	PI7
	20,21,28,29	1-10-(x)	/
	24,25,26,27	110--	PI8
	24,25,28,29	11-0-	PI9
	24,25,26,27	110--(x)	/
	24,26,28,30	11--0	PI10
	24,25,28,29	11-0-(x)	/
	24,26,28,30	11--0(x)	/

③

质蕴涵项	0	1	2	3	4	5	10	11	14	20	21	24	25	26	27	28	29	30
PI1(0,1,2,3)	X	X	X	X														
PI2(0,1,4,5)	X	X			X	X												
PI3(2,3,10,11)			X	X			X	X										
PI4(4,5,20,21)					X	X				X	X							
PI5(10,11,26,27)							X	X						X	X			
PI6(10,14,26,30)							X		X					X				X
PI7(20,21,28,29)										X	X					X	X	
PI8(24,25,26,27)												X	X	X	X			
PI9(24,25,28,29)												X	X			X	X	
PI10(24,26,28,30)												X		X		X		X

质蕴涵项	0	2	4	11	20	25	27	29
~~PI1(0,1,2,3)~~	×	×						
~~PI_2(0,1,4,5)~~	×		×					
~~PI_3(2,3,10,11)~~		×		×				
~~PI_4(4,5,20,21)~~			×		×			
~~PI_5(10,11,26,27)~~				×			×	
PI6(20,21,28,29)					×			×
PI8(24,25,26,27)						×	×	
PI9(24,25,28,29)						×		×

∴ $F = PI6 + PI1 + PI4 + PI5 + PI9 = -1-10 + 000-- + -010- + -10 1- + 11-0-$

$= WYZ' + \cancel{X'Y'}V'W'X' + W'XY' + WX'Y + VWY'$

6.0 (a) ①

组别	最小项	UVWXYZ	合并否
1	1	000001	√
2	5	000101	√
	9	001001	√
3	13	001101	√
	21	010101	√
	37	100101	√
4	23	010111	√
	29	011101	√
	45	101101	√
	53	110101	√
5	31	011111	√
	61	111101	√

②

组别	最小项组	UVWXYZ	合并否
1	1,5	000-01	√
	1,9	00-001	√
2	5,13	00-101	√
	5,21	0-0101	√
	5,37	-00101	√
	9,13	001-01	√
3	13,29	0-1101	√
	13,45	-011 01	√
	21,23	0101-1	√
	21,53	-1010 1	√
	~~29,61~~	~~-111 01~~	√
	37,45	10-101	√
	37,53	1-0101	√
4	23,31	01-111	√
	29,31	011 1-1	√
	29,61	-1110 1	√
	45,61	1-110 1	√
	53,61	11-101	√

组别	最小项组	UVWXYZ	合并后
1	1,5,9,13	00--01	PI2
	1,5,9,13(重)	00--01(X)	/
2	~~5,13,21,29~~	~~0--101~~(重)	PI3
	5,13,37,45	-0-101	✓
	5,13,21,29	0--101(X)	/
	5,21,37,53	--0101	✓
	5,13,37,45	-0-101(X)	/
	5,21,37,53	--0101(X)	/
3	13,29,45,61	--1101	✓
	13,29,45,61	--1101(X)	/
	21,23,29,31	01-1-1	PI4
	21,29,53,61	-1-101	✓
	21,23,29,31	01-1-1(X)	/
	21,29,53,61	-1-101(X)	/
	37,45,53,61	1--101	PI5
	37,45,53,61	1--101(X)	/

组别	最小项组	UVWXYZ	结果
2	5,13,21,29,37,45,53,61	---101	PI1
	5,13,21,29,37,45,53,61	---101(X)	/

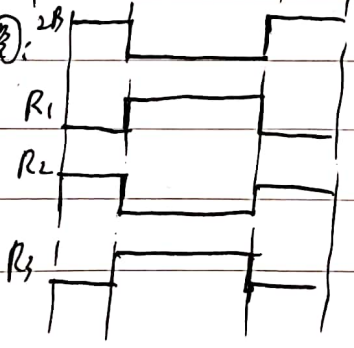
③

原组合	1	5	9	13	21	23	29	31	37	45	53	61
PI1(5,13,21,29,37,45,53,61)		X		X	X		X		X	X	X	X
PI2(1,5,9,13)	X	X	X	X								
PI3(5,13,21,29)		X		X	X		X					
PI4(21,23,29,31)					X	X	X	X				
PI5(37,45,53,61)									X	X	X	X

$$\therefore F = PI1 + PI2 + PI4 = ---01 + 00--01 + 01-1-1$$
$$= XY'Z + U'V'Y'Z + U'VXZ$$

61. 三个表决器分别为 R_1, R_2, R_3

定时图:



功能：使2B始终输出高电平

因为2B和R3一定有一个为1

经过或门后为1

名字：输入电路2B看在表决器表决结果信号

音译于《哈姆雷特》著名台词

"to be or not to be"相似发音