

答案

- 一.
1. 21.375
 2. 10101, 101100
 3. 11010011 (注意符号位)
 4. 00010011 0010
 5. $A \cdot (\bar{A} + B) = A \cdot B$
 6. $(A+B) \cdot C \cdot \bar{D}$
 7. 5 11 2"
 8. 64

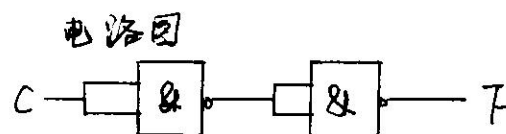
二.

$$\begin{aligned}
 F &= (C + \bar{A}B)[(\bar{A}\bar{B} + B) \cdot C + A] \\
 &= (C + \bar{A}B)[\bar{A}\bar{B}C + BC + A] \\
 &= \bar{A}\bar{B}C + BC + AC + \bar{A}BC
 \end{aligned}$$

BC	00	01	11	10
A				
0		1	1	
1		1	1	

F的卡诺图

化简得 $F = C$



三.

状态方程:

$$Q_2^{n+1} = Q_1^n$$

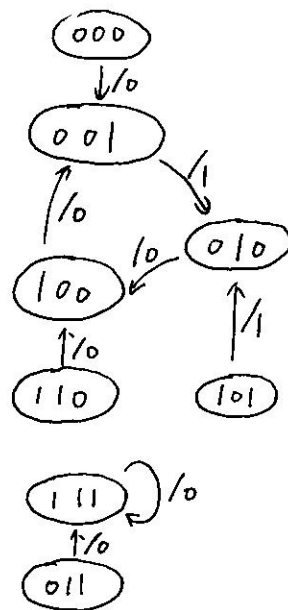
$$Q_1^{n+1} = Q_0^n$$

$$\begin{aligned}
 Q_0^{n+1} &= 1Y = \bar{A}\bar{A}_0D_0 + \bar{A}A_0D_1 + \bar{A}A_0D_2 + A_1A_0D_3 \\
 &= \bar{Q}_2^n\bar{Q}_1^n\bar{Q}_0^n + \bar{Q}_2^nQ_1^nQ_0^n + Q_2^n\bar{Q}_1^n\bar{Q}_0^n + Q_2^nQ_1^nQ_0^n \\
 &= \bar{Q}_2^n\bar{Q}_0^n + Q_2^nQ_0^n \\
 &= Q_2^n \odot Q_0^n
 \end{aligned}$$

状态转移真值表

$Q_2^n Q_1^n Q_0^n$	$Q_2^{n+1} Q_1^{n+1} Q_0^{n+1}$	Z
0 0 0	0 0 1	0
0 0 1	0 1 0	1
0 1 0	1 0 0	0
0 1 1	1 1 1	0
1 0 0	0 0 1	0
1 0 1	0 1 0	1
1 1 0	1 0 0	0
1 1 1	1 1 1	0

状态图



输出方程

$$Z = \bar{Q}_2^n Q_0^n \text{ (分析过程同 } Q_0^{n+1})$$

四.

N	二进制数					十进制数				
	CD	B_2	B_1	B_0	D_{21}	D_2	D_1	D_0	D_{-1}	
0	0	0	0	0	0	0	0	0	0	
1	0	0	0	0	1	0	0	0	1	
2	0	0	0	1	0	0	0	1	0	
3	0	0	0	1	1	0	0	1	1	
4	0	0	1	0	0	0	1	0	0	
5	0	0	1	0	1	0	0	1	0	
6	0	0	1	1	0	0	1	1	0	
7	0	0	1	1	1	0	1	1	1	
8	0	1	0	0	0	0	1	0	0	
9	0	1	0	0	1	0	1	0	1	
10	0	1	0	1	0	1	0	0	0	
11	0	1	0	1	1	1	0	0	1	
12	0	1	1	0	0	1	0	0	1	
13	0	1	1	0	1	1	0	0	1	
14	0	1	1	1	0	1	0	1	0	
15	0	1	1	1	1	1	0	1	0	
16	1	0	0	0	0	1	0	1	1	

N	二进制数				十进制数			
	C ₀	B ₂ B ₂ B ₁ B ₀	D ₂₁	D ₂ D ₄ D ₂ D ₁				
17	1	0 0 0 1	1	0 1 1 1				
18	1	0 0 1 0	1	1 0 0 0				
19	1	0 0 1 1	1	1 0 0 1				

两位二进制数与NBCD码对应表

从表中可以看出, 对于十进制数 10~19, 需要对二进制数进行相应修正才能得到NBCD码。修正就是二进制数加上0110 (即6), 其中10~19分两类, 对于16~19, 条件是CD=1,

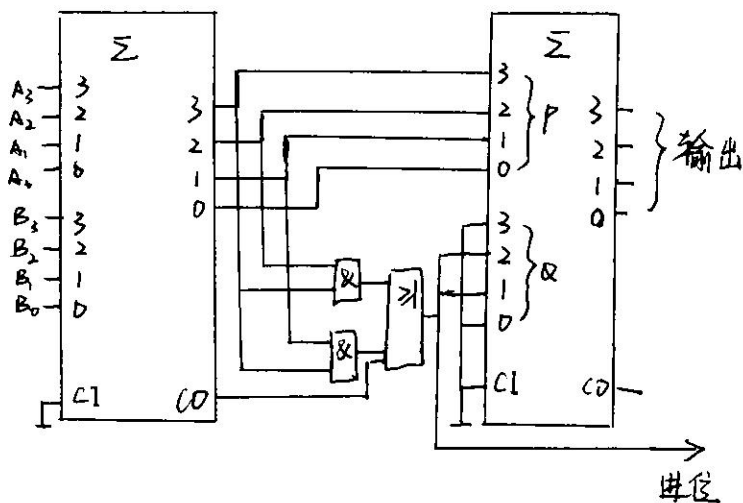
对于 10~15, 列由下卡诺图得:

$B_3 B_2$	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	0	0	1	1

$$F = B_3 B_2 + B_3 B_1$$

综上知, 需进行加 010 修正的条件是

$$F = CO + B_3 B_2 + B_3 B_1$$



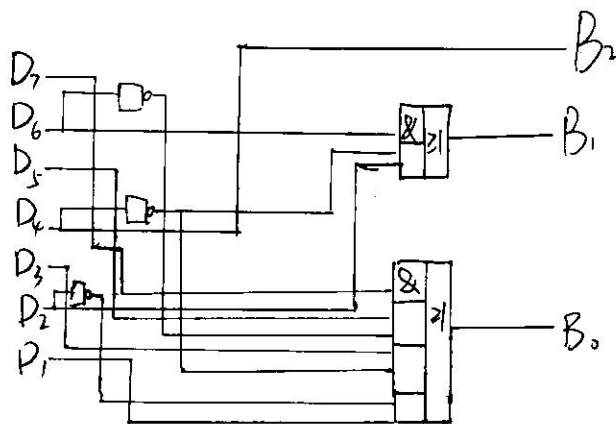
五

$D_7 D_6 D_5 D_4 D_3 D_2 D_1$	$B_2 B_1 B_0$
1 1 1 1 1 1 1	1 1 1
0 1 1 1 1 1 1	1 0 0
0 0 1 1 1 1 1	1 0 1
0 0 0 1 1 1 1	1 0 0
0 0 0 0 1 1 1	0 1 1
0 0 0 0 0 1 1	0 1 0
0 0 0 0 0 0 1	0 0 1
0 0 0 0 0 0 0	0 0 0

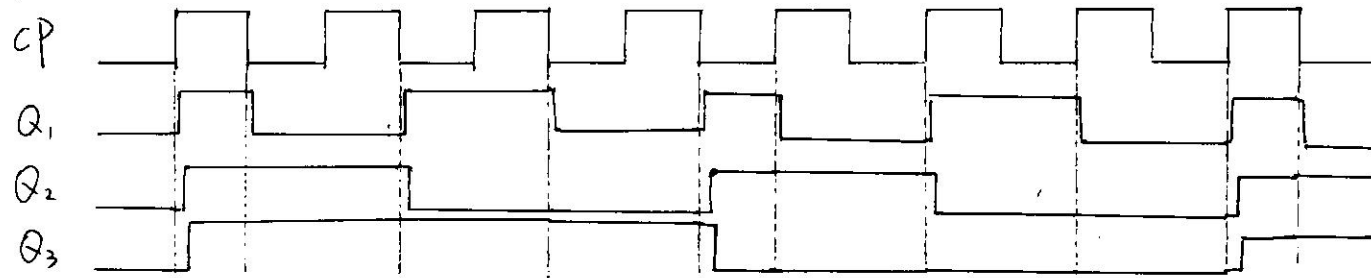
$$B_2 = D_4$$

$$B_1 = D_6 + D_2 \bar{D}_6$$

$$B_0 = D_7 + D_5 \bar{D}_6 + \bar{D}_4 D_3 + D_1 \bar{D}_2$$



六



$$Q_3^{n+1} = \bar{Q}_3^n, CP_3 = Q_2^n \uparrow$$

$$Q_2^{n+1} = \bar{Q}_2^n, CP_2 = Q_1^n \uparrow$$

$$Q_1^{n+1} = \bar{Q}_1^n, CP_1 = (Q_3 \oplus Q_1) \uparrow$$

Q_3^n	Q_2^n	Q_1^n	CP	CP_3	CP_2	CP_1	Q_3^{n+1}	Q_2^{n+1}	Q_1^{n+1}
0	0	0	↑	↑	↑	↑	1	1	1
1	1	1	↓	-	-	↑	1	1	0
1	1	0	↓	-	↑	↑	1	0	1
1	0	1	↓	-	-	↑	1	0	0
1	0	0	↓	↑	↑	↑	0	1	1
0	1	1	↑	-	-	↑	0	1	0
0	1	0	↑	-	↑	↑	0	0	1
0	0	1	↑	-	-	↑	0	0	0

七.

状态转移表 (用3个D触发器)

Q_3^n	Q_2^n	Q_1^n	Q_3^{n+1}	Q_2^{n+1}	Q_1^{n+1}	Z
0	0	0	0	0	1	1
0	0	1	0	1	0	1
0	1	0	0	1	1	1
0	1	1	1	0	0	0
1	0	0	1	0	1	1
1	0	1	0	0	0	0
1	1	0	1	1	1	1
1	1	1	1	0	0	0

Q_3^n	$Q_2^n Q_1^n$	00	01	11	10
0	0	0	0	1	0
1	1	1	1	1	1

Q_3^{n+1}

Q_3^n	$Q_2^n Q_1^n$	00	01	11	10
0	1	0	0	1	
1	1	0	0	1	

Q_2^{n+1}

Q_3^n	$Q_2^n Q_1^n$	00	01	11	10
0	0	1	0	1	
1	0	1	0	1	

Q_1^{n+1}

Q_3^n	$Q_2^n Q_1^n$	00	01	11	10
0	1	1	0	1	
1	1	0	0	1	

Z

状态方程:

$$Q_3^{n+1} = Q_3^n + Q_2^n Q_1^n$$

$$Q_2^{n+1} = \overline{Q_2^n} Q_1^n + Q_2^n \overline{Q_1^n} = Q_2^n \oplus Q_1^n$$

$$Q_1^{n+1} = \overline{Q_1^n}$$

$$Z = \overline{Q_1^n} + \overline{Q_3^n} \overline{Q_2^n} = \overline{Q_1^n \cdot (Q_3^n + Q_2^n)} = \overline{Q_3^n Q_1^n + Q_2^n Q_1^n}$$

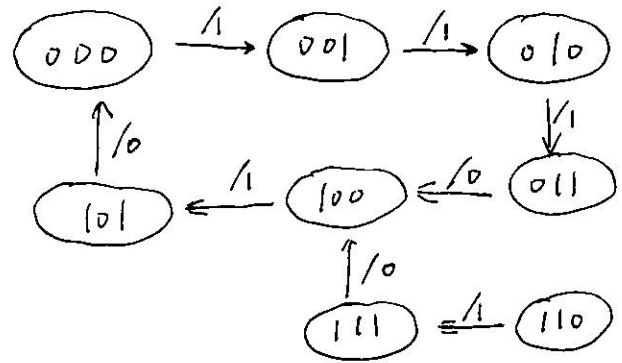
电路图 略

考虑自启动, 在 $Q_3^n Q_2^n Q_1^n$ 为 110 和 111

时为增加状态, 为简化电路, 故

如状态转移表设置

状态图



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