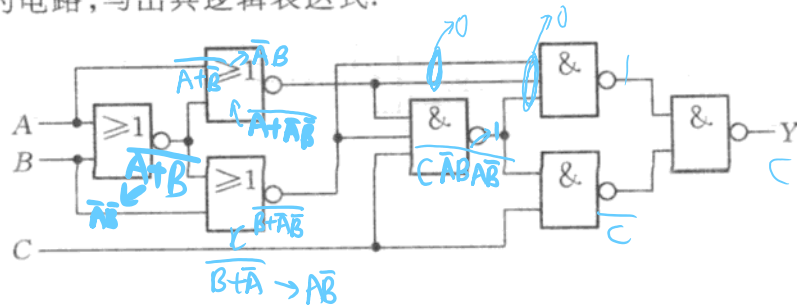


第二章作业

10213903403 岳锦鹏

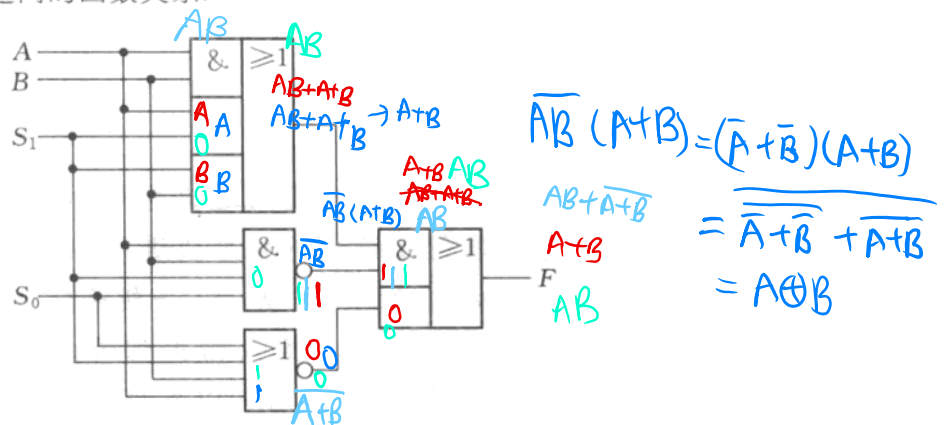
2023年10月11日, 星期三 20:59

1. 分析下图所示的电路, 写出其逻辑表达式.



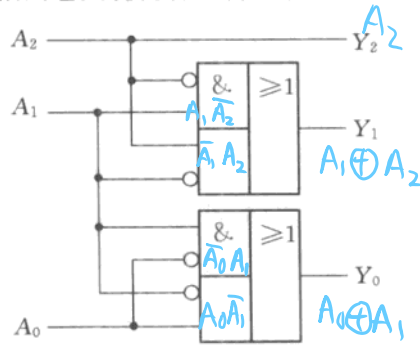
$$Y = C$$

2. 分析下图所示的逻辑, 其中 $S_1 \sim S_0$ 作为功能选择端. 列表说明当 $S_1 \sim S_0$ 作不同的选择时, 输出 F 与输入 A 、 B 之间的函数关系.



S_0	S_1	F
0	0	$AB + \overline{A}\overline{B}$
0	1	$A+B$
1	0	AB
1	1	$A \oplus B$

4. 分析下图所示的逻辑电路,指出它实现何种逻辑功能.



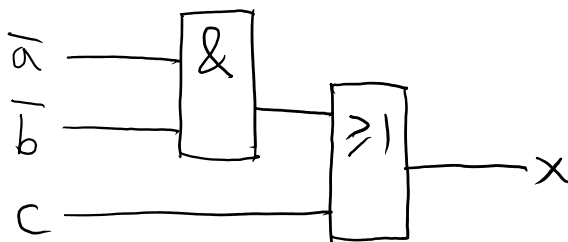
A_2	A_1	A_0	Y_2	Y_1	Y_0
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	1	1
0	1	1	0	1	0
1	0	0	1	1	0
1	0	1	1	1	1
1	1	0	1	0	1
1	1	1	1	0	0

由于输出的任意两个相邻的代码只有一位二进制数不同, 所以此逻辑电路实现了二进制码转格雷码的功能。

5. 用尽可能少的集成电路分别实现下列逻辑函数, 假设输入变量及其反变量已知:

$$x = f(a, b, c) = \sum m(0, 1, 3, 5, 7)$$

$$x = f(a, b, c) = \sum m(0, 1, 3, 5, 7) = \sum M(2, 4, 6) = \bar{a}\bar{b} + c$$



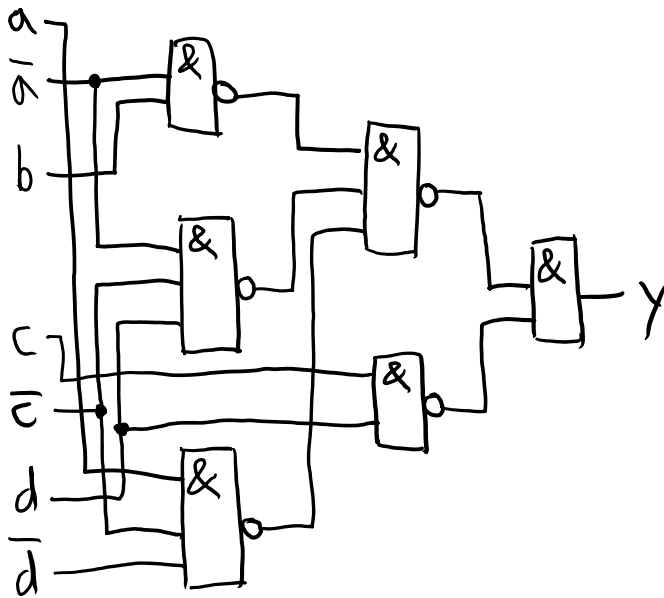
$ab \backslash c$	0	1
00	1	1
01	0	1
11	0	1
10	0	1

$$y = f(a, b, c, d) = \sum m(1, 4, 5, 7, 8, 12)$$

		cd			
		00	01	11	10
ab	00	0	1	0	0
	01	1	1	1	0
	11	1	0	0	0
	10	1	0	0	0

$$y = (\bar{a}b + \bar{a}\bar{c}d + a\bar{c}\bar{d})\bar{c}\bar{d}$$

$$= \overline{\bar{a}b \bar{a}\bar{c}d a\bar{c}\bar{d} c\bar{d}}$$



$$z = f(a, b, c, d, e) = \sum m(0, 1, 3, 4, 6, 7, 15, 21, 25)$$

$$Z = \sum m(0, 1, 3, 4, 6, 7) + m_{15} + \sum m(21, 25)$$

$$= \bar{a}\bar{b} \sum M(2, 5) + \bar{a}m_{15} + m_{21} + m_{25}$$

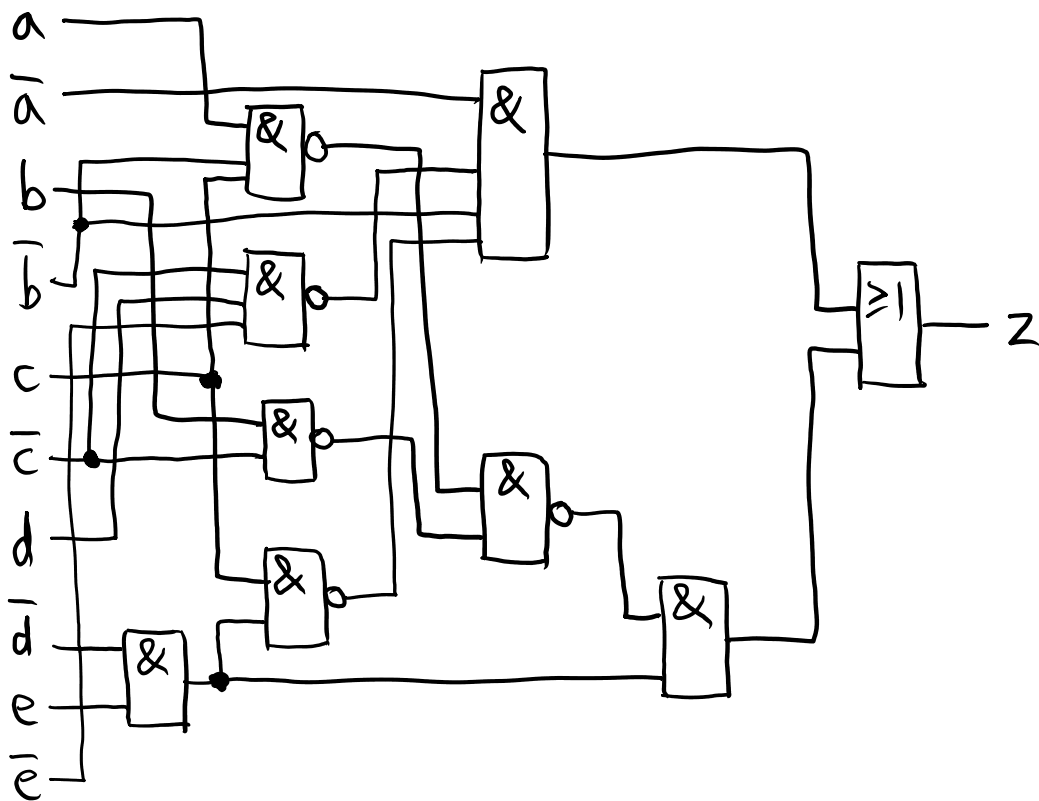
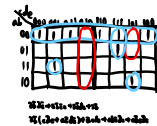
$$= \bar{a}\bar{b}(c+d+e)(\bar{c}+\bar{d}+\bar{e}) + \bar{a}b\bar{c}\bar{d}e + a\bar{b}c\bar{d}e + abc\bar{d}e$$

cd \ e	0	1
00	1	1
01	0	1
11	1	1
10	1	0

$$= \bar{a}\bar{b} \overline{cde} \overline{cde} + b\bar{c}\bar{d}e + a\bar{b}c\bar{d}e$$

$$= \bar{a}\bar{b} \overline{cde} \overline{cde} + (b\bar{c} + a\bar{b}c)\bar{d}e$$

$$= \bar{a}\bar{b} \overline{cde} \overline{cde} + \overline{b\bar{c} + a\bar{b}c} \bar{d}e$$



9. 设计一个 4-2 优先编码器. 输入 $I_0 \sim I_3$, 其中 I_3 的优先级最高. 没有选通输入. 输出 Y_0, Y_1 , 高电平有效. 构造真值表, 画出逻辑图.

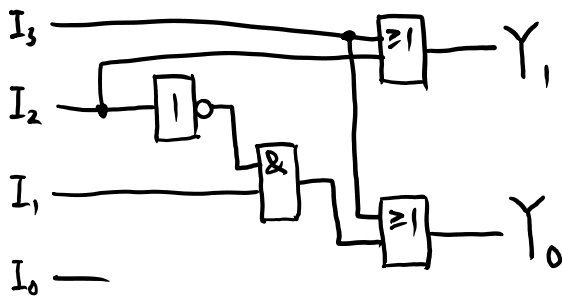
题意应该是不考虑扩展输出

I_3	I_2	I_1	I_0	Y_1	Y_0
0	0	0	X	0	0
0	0	1	X	0	1
0	1	X	X	1	0
1	X	X	X	1	1

$$Y_1 = I_3 + I_2$$

$$Y_0 = I_3 + \bar{I}_3 \bar{I}_2 I_1$$

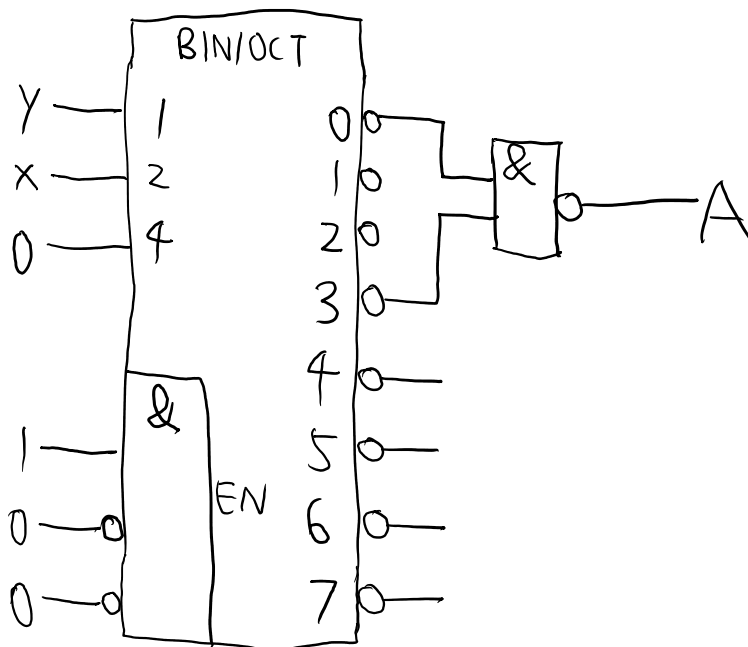
$$= I_3 + \bar{I}_2 I_1$$



13. 用译码器和必要的门电路实现下列函数.

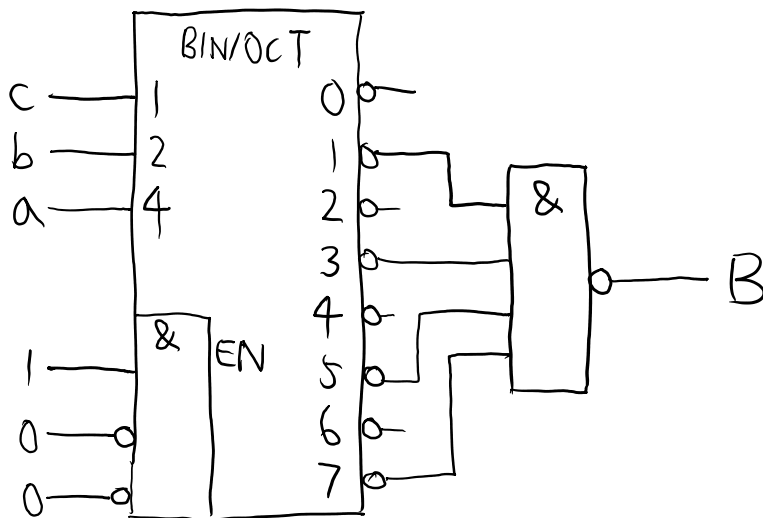
$$A = f(x, y) = \sum m(0, 3)$$

$$A = m_0 + m_3 = \overline{Y_0} \overline{Y_3}$$



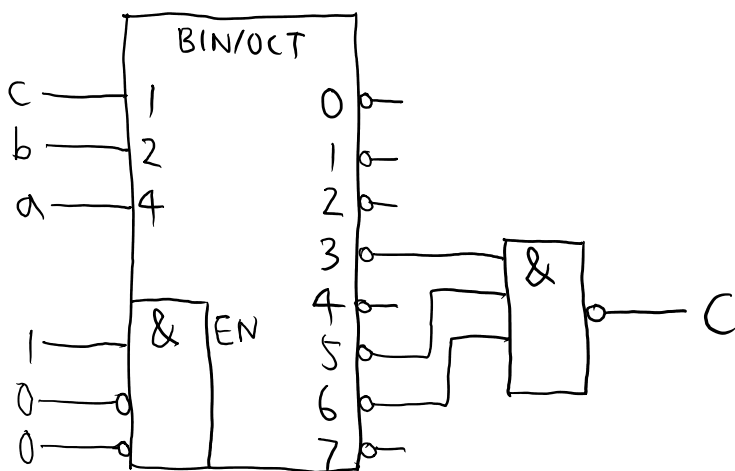
$$B = f(a, b, c) = \sum m(1, 3, 5, 7)$$

$$B = m_1 + m_3 + m_5 + m_7 = \overline{Y_1} \overline{Y_3} \overline{Y_5} \overline{Y_7}$$



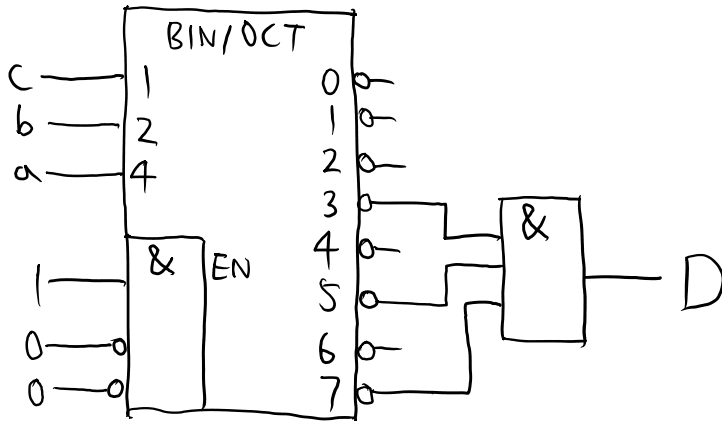
$$C = f(a, b, c) = \sum m(3, 5, 6)$$

$$C = m_3 + m_5 + m_6 = \overline{Y_3} \overline{Y_5} \overline{Y_6}$$



$$D = f(a, b, c) = \prod M(3, 5, 7)$$

$$D = M_3 + M_5 + M_7 = \overline{Y_3 + Y_5 + Y_7} = \overline{Y_3} \overline{Y_5} \overline{Y_7}$$

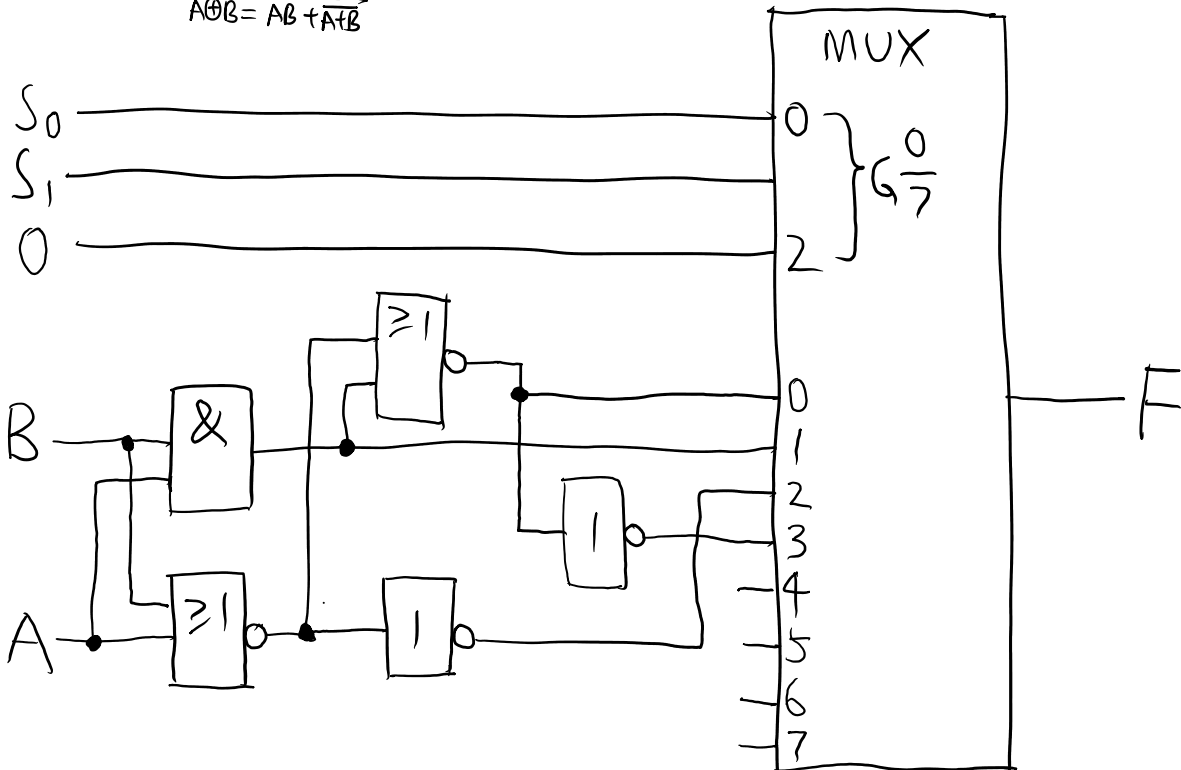


15. 用 8 选 1 数据选择器实现下表所示的逻辑函数, 不允许反变量输入.

$S_1 S_0$	$F(A, B)$	$S_1 S_0$	$F(A, B)$
00	$A \oplus B$	10	$A + B$
01	$A \cdot B$	11	$A \odot B$

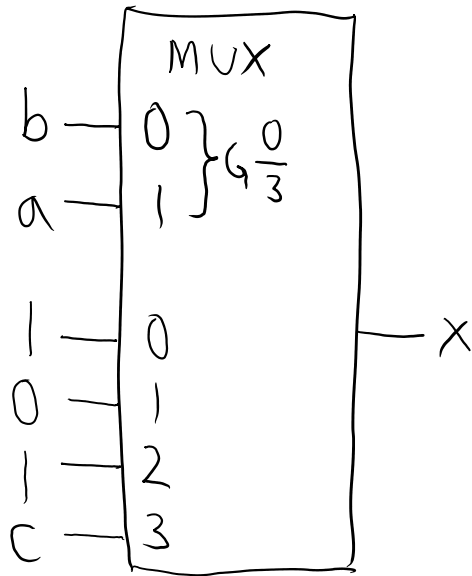
$$A \odot B = AB + \overline{A} \overline{B}$$

$$A \oplus B = \overline{AB} + \overline{\overline{A} \overline{B}}$$



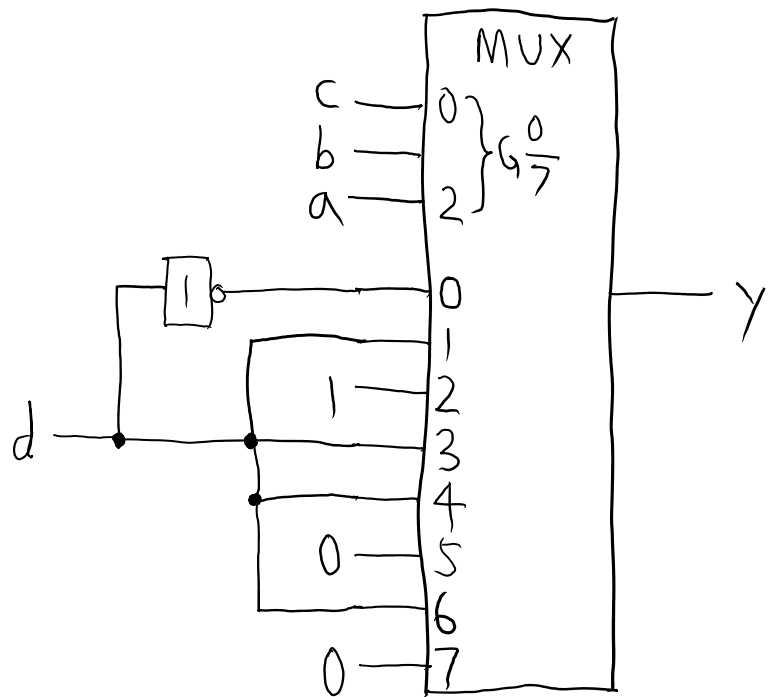
16. 如果允许单个变量采用影射变量,用合适的数据选择器实现下列逻辑函数.

$$x = (a, b, c) = \sum m(0, 1, 4, 5, 7)$$



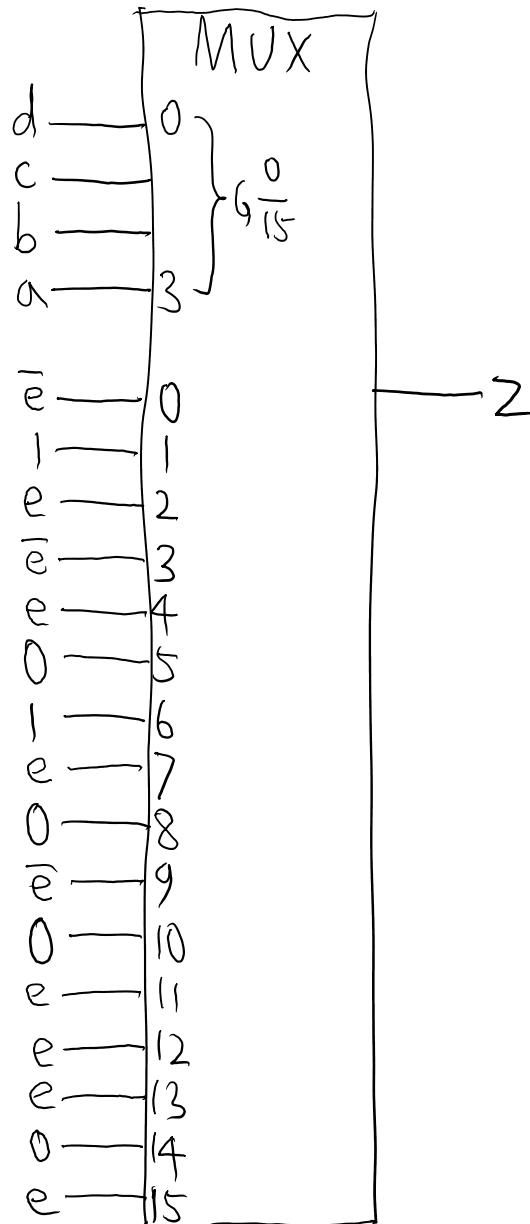
$$y = (a, b, c, d) = \sum m(0, 3, 4, 5, 7, 9, 13, 15)$$

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



$$z = (a, b, c, d, e) = \sum m(0, 2, 3, 4, 6, 9, 12, 13, 15, 19, 23, 25, 26, 31)$$

ab \ cde	000	001	011	010	110	111	101	100
00	1	0	1	1	1	0	0	1
01	0	1	0	0	0	1	1	1
11	0	1	0	1	0	1	0	0
10	0	0	1	0	0	1	0	0



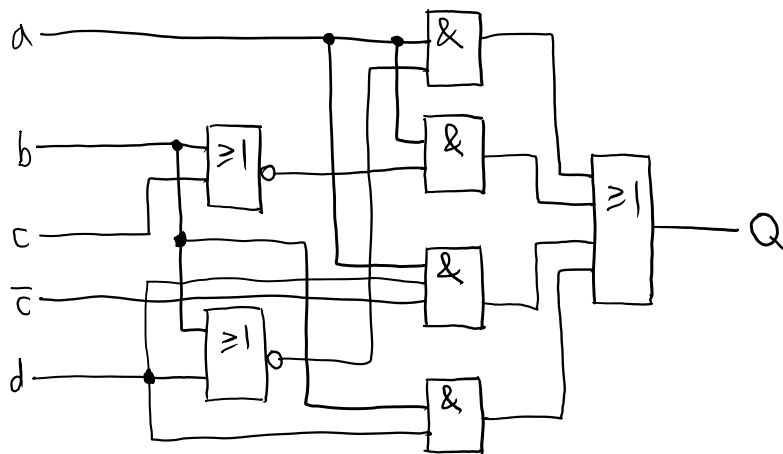
21. 用最少的集成逻辑门设计下列逻辑函数,要求在单个输入变化时不发生冒险.

$$Q = f(a, b, c, d) = \sum m(5, 7, 8, 9, 10, 11, 13, 15)$$

		cd			
	ab	00	01	11	10
00		0	0	0	0
01		0	1	1	0
11		0	1	1	0
10		1	1	0	1

$$Q = bd + a\bar{c}d + a\bar{b}\bar{c} + a\bar{b}\bar{d}$$

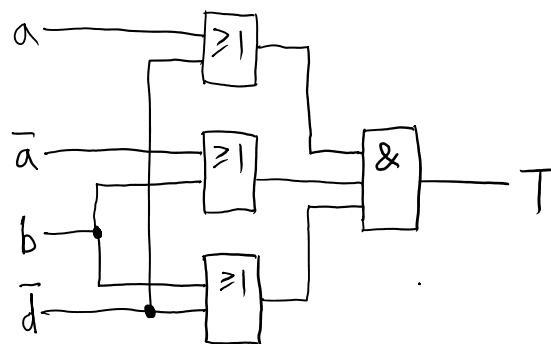
$$= bd + a\bar{c}d + a(\overline{b+c}) + a(\overline{b+d})$$



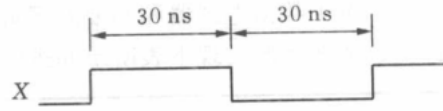
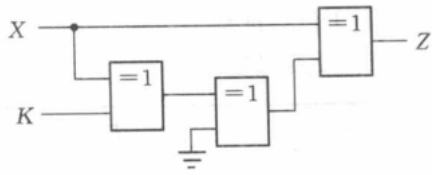
$$T = f(a, b, c, d) = \sum m(0, 2, 4, 6, 12, 13, 14, 15)$$

		cd			
	ab	00	01	11	10
00		1	0	0	1
01		1	0	0	1
11		1	1	1	1
10		0	0	0	0

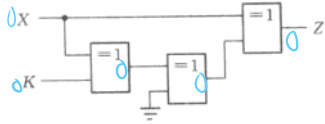
$$T = (\bar{a} + b)(a + \bar{d})(b + \bar{d})$$



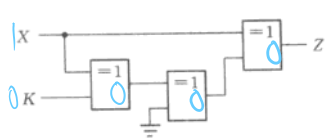
22. 已知在下图所示的电路中各异或门的延时为 $t_{PD} = 5 \text{ ns}$. 在考虑该延时特性后, 试画出 $K = 0$ 和 $K = 1$ 两种情况下的输出波形.



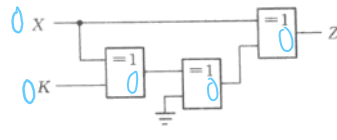
$K = 0$



$\downarrow X = \sqrt{\quad}$

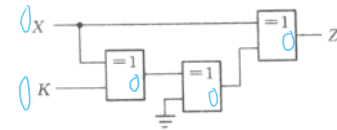
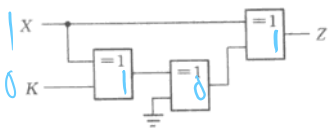


$\xrightarrow{30\text{ns}}$
 $X = \lceil \quad \rceil$

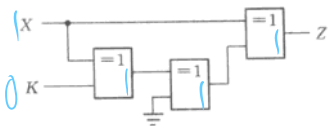


$\downarrow 5\text{ns}$

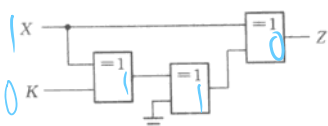
$\downarrow 5\text{ns}$ (不变)



$\downarrow 5\text{ns}$



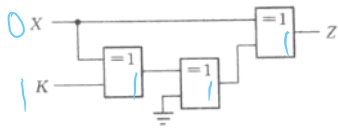
$\downarrow 5\text{ns}$



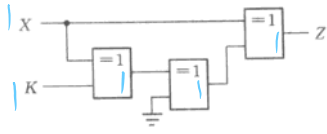
$\downarrow 5\text{ns}$ (不变)



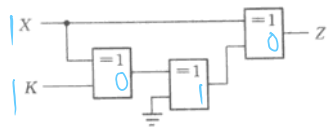
$K=1$



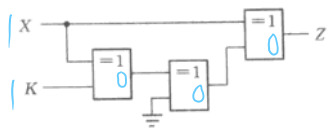
$\downarrow X=1$



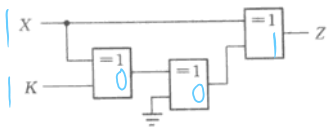
$\downarrow 5ns$



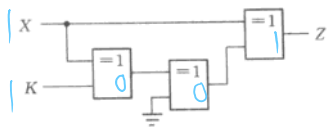
$\downarrow 5ns$



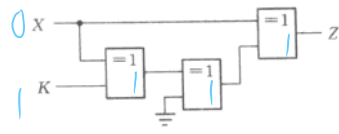
$\downarrow 5ns$



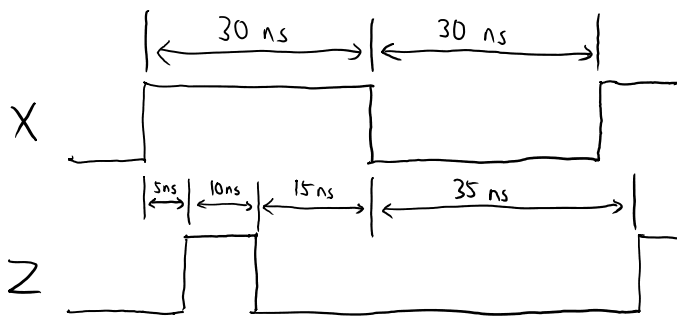
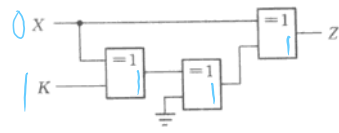
$\downarrow 5ns$ (不变)



$\xrightarrow{30ns}$
 $X=0$



$\downarrow 5ns$ (不变)



(K=0) Z

(K=1) Z

