

1. ① 每个元件本身是组合逻辑电路

② 输出连线不能互连

③ 输出连线不能反馈到连线输入端

2. 三态门:

特点: 其输出既可以是0, 1, 又可以是高阻态.

同时有一个额外的输出使能控制端 EN

工作方式: 用于连接总线, 多个三态输出连在一起等

3. $x = b \oplus a$

$$y = c \oplus b$$

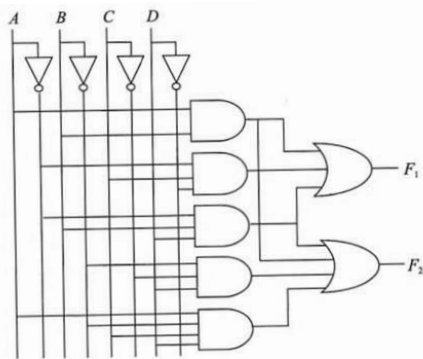
$$z = c$$

$$\Rightarrow c = z$$

$$b = c \oplus y = z \oplus y$$

$$a = b \oplus x = z \oplus y \oplus x$$

4.



$$F_1 = AB + \bar{A}C\bar{D} + \bar{A}BD$$

$$F_2 = AB + \bar{A}BD + \bar{B}\bar{C}D + \bar{A}\bar{B}CD$$

5.

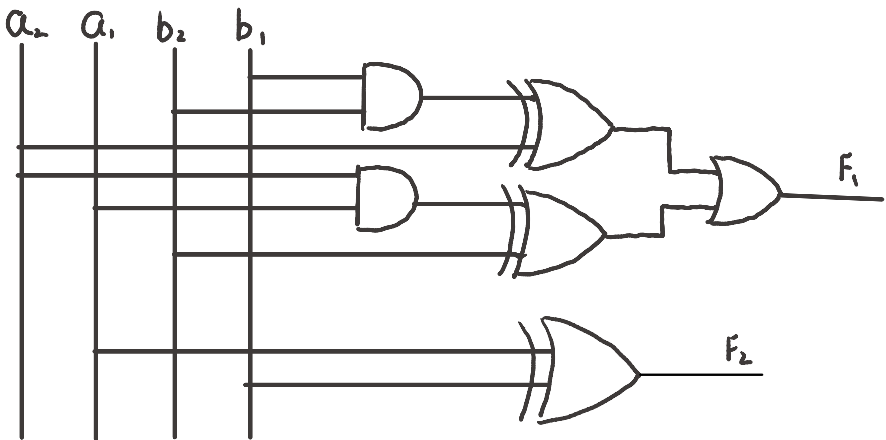
a_2	a_1	b_2	b_1	$ A-B $
0	0	0	0	0 0
0	0	0	1	0 1
0	0	1	0	1 0
0	0	1	1	1 1
0	1	0	0	0 1
0	1	0	1	0 0
0	1	1	0	0 1
0	1	1	1	1 0
1	0	0	0	1 0
1	0	0	1	0 1
1	0	1	0	0 0
1	0	1	1	0 1
1	1	0	0	1 1
1	1	0	1	1 0
1	1	1	0	0 1
1	1	1	1	0 0

$a_2 a_1$	00	01	11	10
$b_2 b_1$				
00			1	1
01			1	
11	1	1		
10	1			

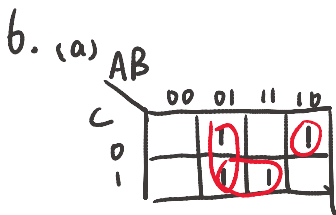
$$a_2 \bar{b}_2 \bar{b}_1 + a_2 a_1 \bar{b}_2 + \bar{a}_2 b_1 b_2 + \bar{a}_2 \bar{a}_1 b_2$$

$a_2 a_1$	00	01	11	10
$b_2 b_1$				
00		1	1	
01	1			1
11	1			
10		1	1	

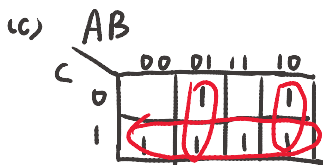
$$\bar{a}_1 b_1 + a_1 \bar{b}_1$$



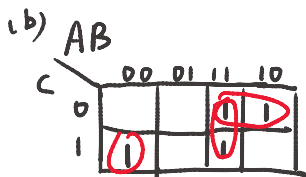
$$|A-B| = (F_1, F_2)$$



$$\bar{A}B + BC + A\bar{B}\bar{C}$$

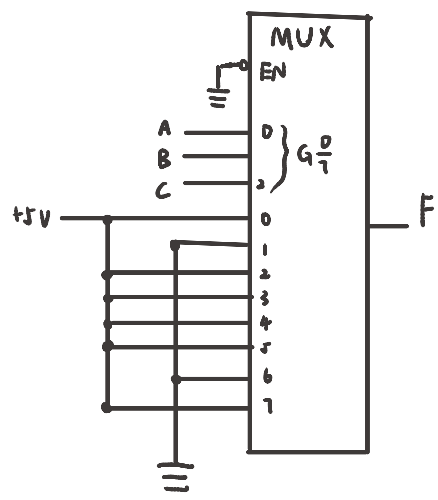


$$C + \bar{A}B + A\bar{B}$$



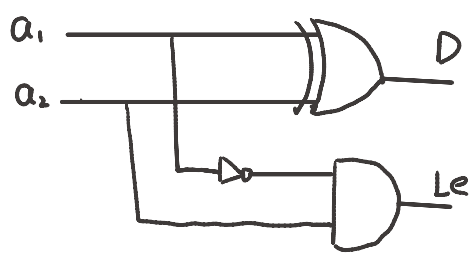
$$A\bar{C} + AB + \bar{A}\bar{B}C$$

7. $F = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}\bar{C} + A\bar{B}C + ABC$



8.

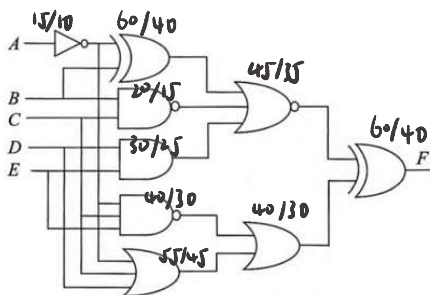
a_1	a_2	D	Le
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0



9.

逻辑门	T_{pd} (ps)	T_{cd} (ps)
NOT	15	10
2 输入 OR	40	30
3 输入 OR	55	45
2 输入 AND	30	25
3 输入 AND	40	30
2 输入 NOR	30	25
3 输入 NOR	45	35
2 输入 NAND	20	15
3 输入 NAND	30	25
2 输入 XOR	60	40

(a)



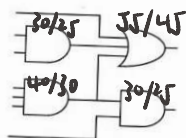
(b)

图5 题9/10图

传输延迟: $15 + 60 + 45 + 60 = 180 \text{ ps}$

最小延迟: $15 + 35 + 40 = 90 \text{ ps}$

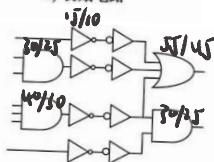
10.



a) 初始电路

$$a) T_{pd} = 40 + 35 = 75 \text{ ps}$$

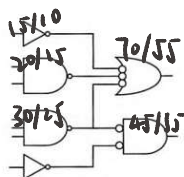
$$T_{cd} = 25 \text{ ps}$$



b) 加入反相器的电路

$$b) T_{pd} = 40 + 15 \times 2 + 35 = 125 \text{ ps}$$

$$T_{cd} = 10 \times 2 + 25 = 45 \text{ ps}$$



c) 使用反相输出端和反向输入端的电路

$$c) T_{pd} = 30 + 70 = 100 \text{ ps}$$

$$T_{cd} = 10 + 35 = 45 \text{ ps}$$

b) 的传输延迟最长, a) 最短