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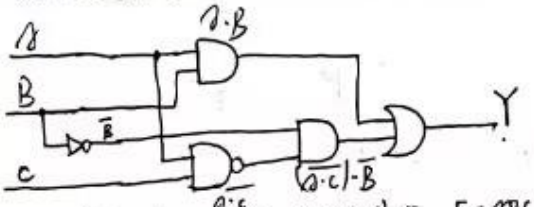
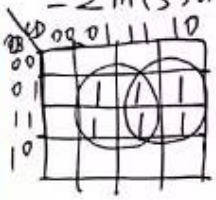
1. 以组合逻辑电路实现以下函数：$Y=(A\cdot B)+\overline{(A\cdot C)}\cdot\overline{B}$.



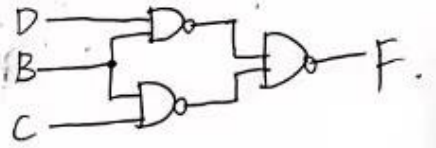
2. 以卡诺图化简，仅用NAND门实现. $F=ABC+B\bar{C}D+\bar{A}BC$.

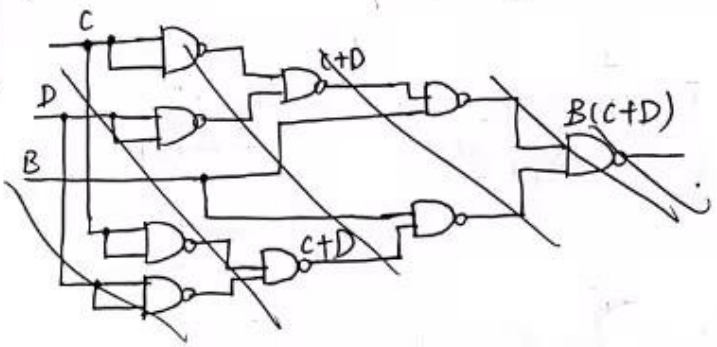
$F=ABC+B\bar{C}D+\bar{A}BC=ABC(D+\bar{D})+(A+\bar{A})B\bar{C}D+\bar{A}BC(D+\bar{D})=ABCD+ABC\bar{D}+AB\bar{C}D+\bar{A}B\bar{C}D+\bar{A}BCD+\bar{A}BC\bar{D}$

$=\sum m(5,6,7,13,14,15)$.



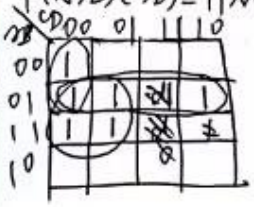
$F=BD+BC$.　　$F=B(C+D)$.



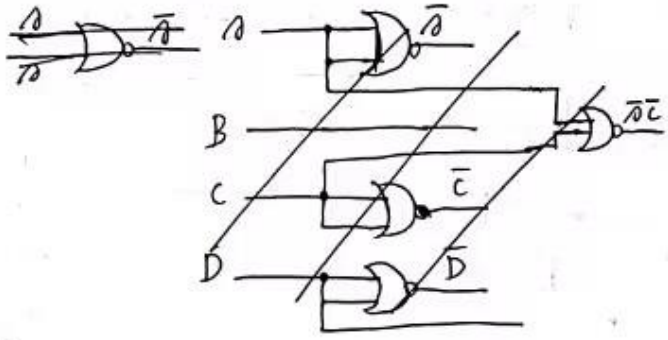


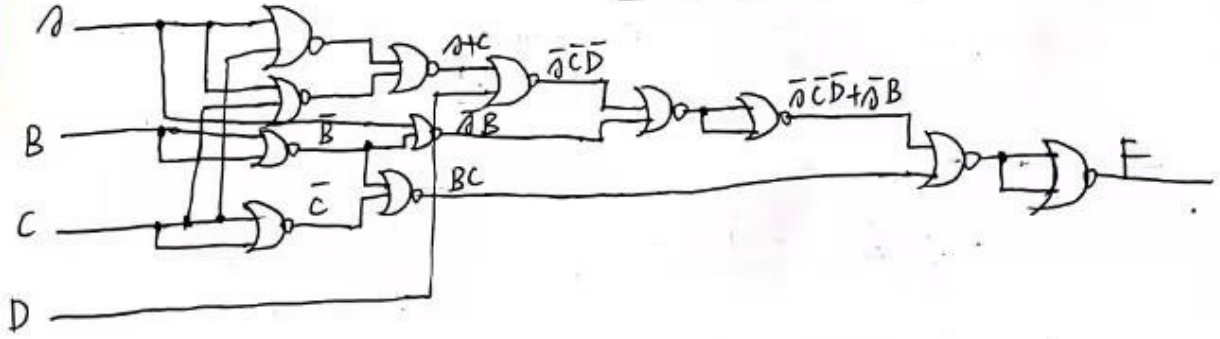
3. 用卡诺图化简以下函数，只用NOR门实现图.

$F(A,B,C,D)=\prod M(1,2,3,8,9,10,11,14)\cdot d(7,15)=\sum m(0,4,5,6,12,13)+d(7,15)$.

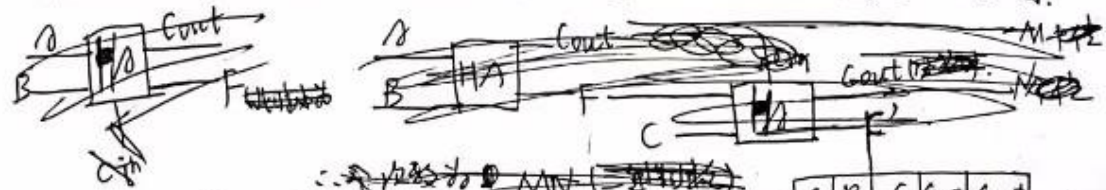


$F=\bar{A}\bar{C}\bar{D}+BC+\bar{A}B=\overline{\bar{A}\bar{C}\bar{D}}\cdot\overline{B\cdot C}\cdot\overline{\bar{A}\cdot B}$





4. 设计一组合电路，功能为统计三个输入A,B,C中"1"出现的次数，写出表达式，画真值表及电路图.

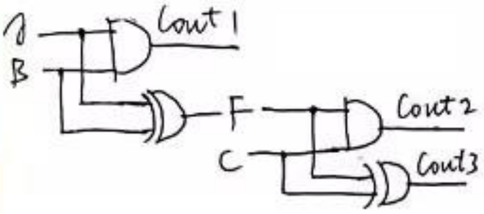


∴ 次数为 MN

真值表

A	B	C	Cout 1	Cout 2
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	[illegible]	[illegible]
1	1	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

最终次数 = Cout1 + Cout1 + Cout2 ("+"为真值表算加)



A	B	C	Cout 1	Cout 2	Cout 3
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	0	1
0	1	1	0	1	0
1	0	0	0	0	1
1	0	1	0	1	0
1	1	0	1	0	0
1	1	1	1	0	1

∴ 次数 = Cout 3 + 2 × (Cout 1 + Cout 2)

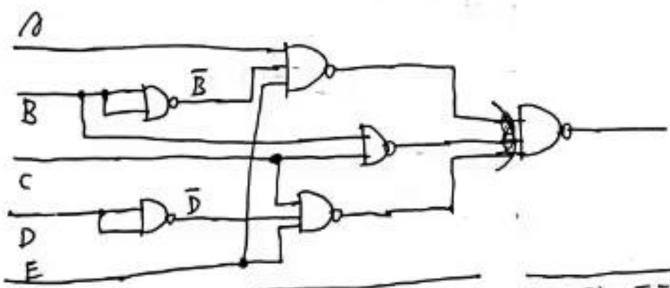
(+与×为真值表意义上的加与乘)

5. 以多级与非门画图：

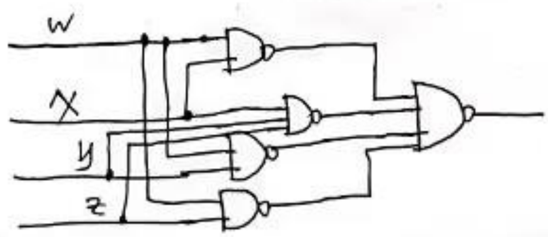
① $(A\bar{B}+C\bar{D})E+BC(A+B)$

$(A\bar{B}+C\bar{D})E+B(A+B) = \overline{\overline{A\bar{B}E+C\bar{D}E+ABC+BC}} = \overline{(\bar{A}+B+\bar{E})\cdot(\bar{C}+D+\bar{E})\cdot(\bar{A}+\bar{B}+\bar{C})\cdot(\bar{B}+\bar{C})}$

$= \overline{\overline{(A\cdot\bar{B}\cdot E)}\cdot\overline{(C\cdot\bar{D}\cdot E)}\cdot\overline{(A\cdot B\cdot C)}\cdot\overline{(B\cdot C)}}$



② $w(x+y+z)+xyz = \overline{\overline{wx+wy+wz+xyz}} = \overline{(\bar{w}+\bar{x})\cdot(\bar{w}+\bar{y})\cdot(\bar{w}+\bar{z})\cdot(\bar{x}+\bar{y}\cdot\bar{z})} = \overline{\overline{(w\cdot x)}\cdot\overline{(w\cdot y)}\cdot\overline{(w\cdot z)}\cdot\overline{(xyz)}}$



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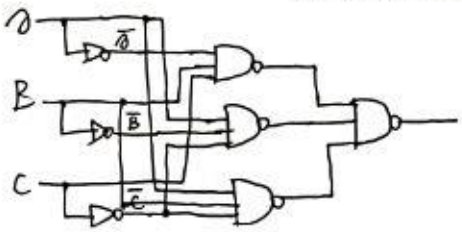
6. 0~9, L_1 L_2 L_3 L_4 L_5 L_6 L_7, 写真值表.

输入	L_1	L_2	L_3	L_4	L_5	L_6	L_7
0	1	0	1	1	1	1	1
1	0	0	0	0	0	1	1
2	1	1	1	0	1	1	0
3	1	1	1	0	0	1	1
4	0	1	0	1	0	1	1
5	1	1	1	1	0	0	1
6	1	1	1	1	1	0	1
7	1	0	0	0	0	1	1
8	1	1	1	1	1	1	1
9	1	1	1	1	0	1	1

7. 奇/偶数个1. 3输入. 奇数个"1"输出0, 反之"1".

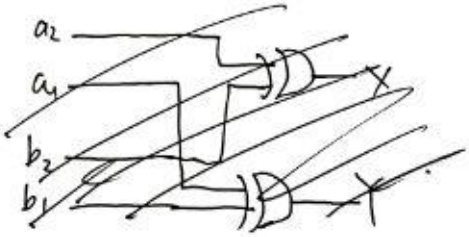
$F=\bar{A}BC+A\bar{B}C+AB\bar{C}=\overline{\overline{\bar{A}BC}\cdot\overline{A\bar{B}C}\cdot\overline{AB\bar{C}}}$.



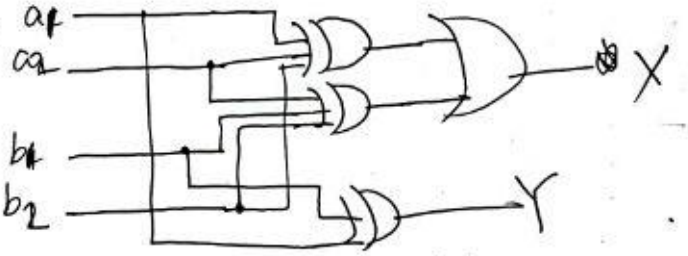
(亦即异或门)

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

8. A(a_2 a_1) B(b_2 b_1), 求|A-B|电路.



$|A-B|=\overline{XY}$ → 表示为XY这个数(2).



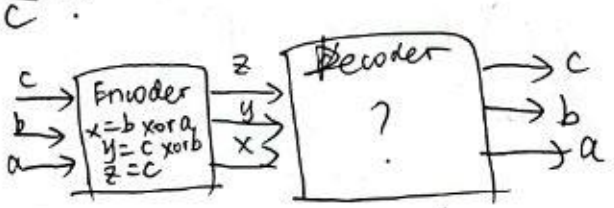
9. 证明n输入的或门可用n-1个2输入的或门实现, 说明对与非或非门是否仍适用.

证明: $\because (A+B+C+D+\cdots+X)=((A+B)+C)+D)+\cdots+X)$, $\therefore$ 对.

n输入或门 (n-1)个2输入或门

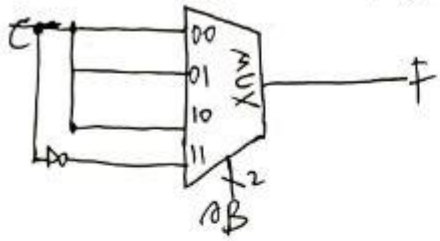
不适用. $\because \overline{A+B+C}\neq\overline{\overline{A+B}+C}$.

10. 设计解码器, (z,y,x)→(c,b,a).

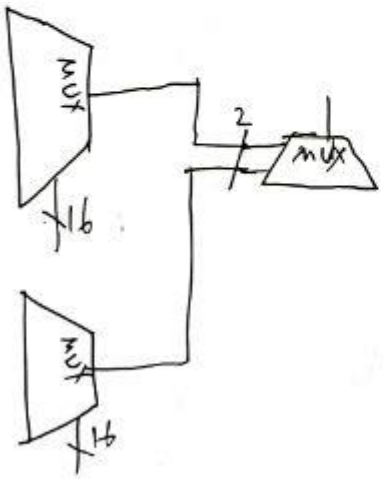


$$?=\begin{cases} c=z, \\ b=y \text{ xor } z, \\ a=x \text{ xor } (y \text{ xor } z). \end{cases}$$

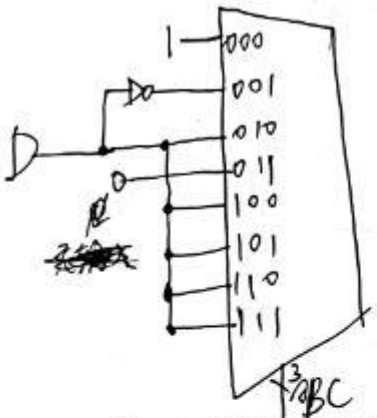
11. 基于4-路选择器实现 $F(A,B,C)=\sum m(3,5,6)$.



12. 用两个16-路和一个2-路选择器设计32-路选择器.



13. 基于8-路选择器实现 $Y(A,B,C,D)=\sum m(0,1,2,5,9,11,13,15)$.



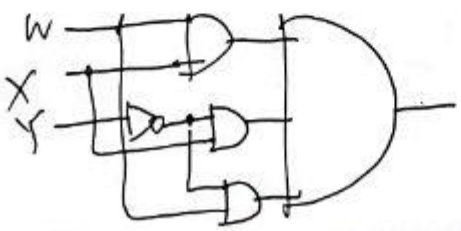
14. 针对下面逻辑表达式，找出对应2级 AND-OR 和 OR-AND 结构的静态冒险，设计能实现同样逻辑功能的无冒险电路.

(1) $F=W\cdot X+W'\cdot Y'$ (2) $F=W\cdot Y+W'\cdot Z'+X\cdot Y'\cdot Z$ (3) $F=(W'+X+Y')\cdot(X'+Z')$ (4) $F=(W+Y+Z')(W+X'+Y+Z)(X'+Y')(X+Z)$.

(1)

W \ XY	00	01	11	10
0	1	0	1	1
1	0	0	1	1

$F=W\cdot X+W'\cdot Y'+XY'$.



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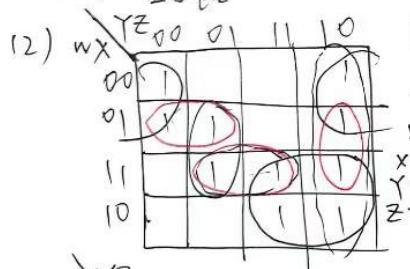
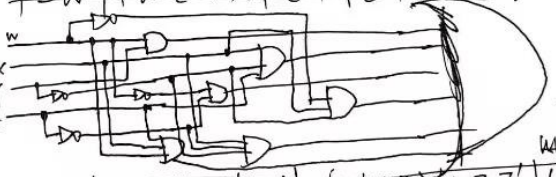
(12) $F = WY + W'Z' + XY'Z + W'XY' + WXZ + XYZ'$.



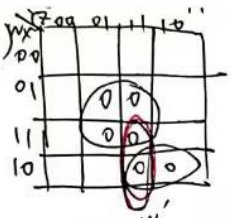
~~$F = WY + W'Z' + XY'Z + YZ' + WXZ$.~~



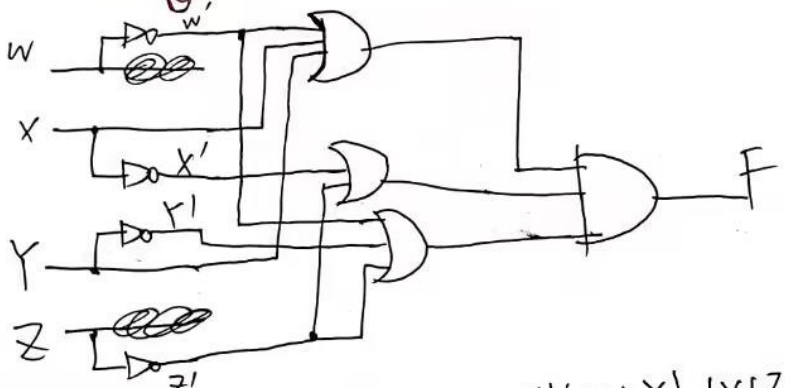
~~$= (W+X+Y')(X'+Z')(W+Y+Z')(W'+X'+Y+Z')$~~

~~$= (W+X+Y')(W'X'+W'Z'+XZ'+X'Y+X'Z')$.

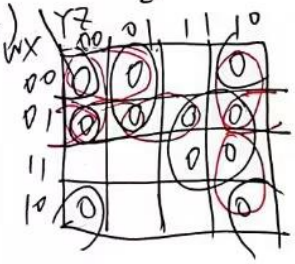
(13)



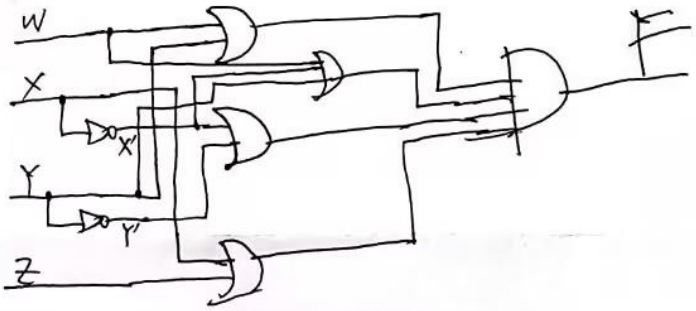
$F = (W'+X+Y')(X'+Z')(W+Y'+Z')$.



~~(14)~~ (14)

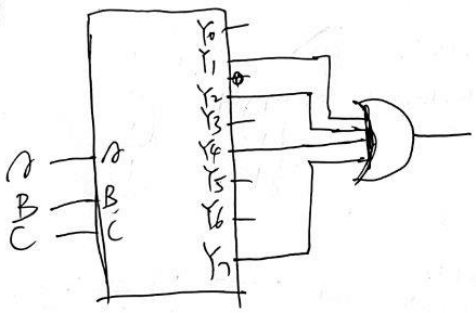


$F = (X'+Y')\cdot(W+Y)\cdot(X+Z)\cdot(W+X'+Y)$.



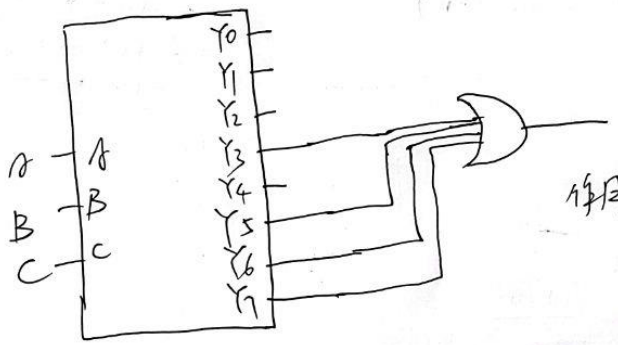
15. 借助一个3-8译码器实现 (1) $S(A,B,C)=\sum m(1,2,4,7)$ (2) $C(A,B,C)=\sum m(3,5,6,7)$，并说明作用

(1)



作用：
有奇数个1则输出1，
有偶数个1则输出0.

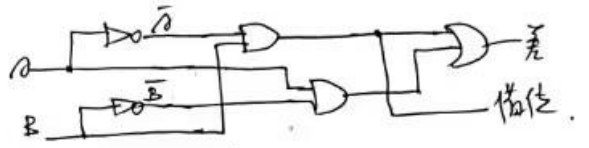
(2)



作用：1的个数大于等于2
则输出1.

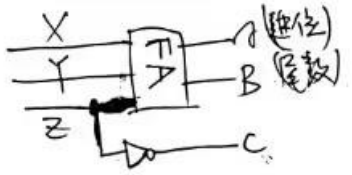
16. 一个半减法器的输入是两位，输出是差位和借位，用与门、或门、反相器构造一个半减器。

A	B	差	借位
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0



差=A⊕B 借位和原时相同.

17. 设计一个具有三个输入x,y,z以及三个输出A、B、C的组合电路。
当二进制输入为0,1,2,3时，输出比输入大1,反之小1.

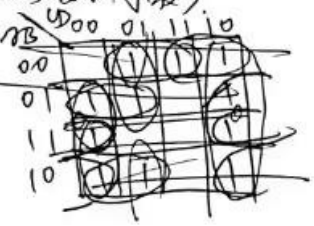


结果输出二进制数 ABC.

19. F(A,B,C,D)：输出为1 iff 输入的1多于1个.
①求最大项表达式. ②使用三级门(AND-OR-NAND)实现，要求门最少.

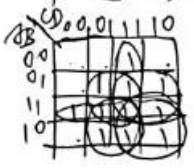
① ~~F(A,B,C,D)=ABC~~ ΠM(0,7,11,13,15).

② ~~F=ĀBC+ABC+AB~~ ΣM(1,2,3,4,5,6,8,9,10,12,14)



① $f(A,B,C,D)=\Pi M(0,1,2,4,8)$.

② $f=\Sigma m(3,5,6,7,9,10,11,12,13,14,15)$.

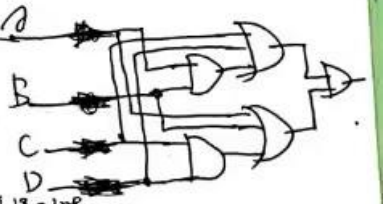


$F=CD+\bar{A}B+B\bar{C}+\bar{A}D+\bar{A}\bar{C}+\bar{B}D$.

$=(\bar{A}+\bar{B}+\bar{C})\cdot(\bar{A}+\bar{B}+D)\cdot(\bar{A}+\bar{C}+D)(\bar{B}+\bar{C}+D)$

$=(\bar{A}+\bar{B}+\bar{C}\cdot\bar{D})\cdot(\bar{C}+D+\bar{A}\bar{B})$.

$=(A+B+C\cdot D)(C+D+\bar{A}B)$



20. 构造一个5-32译码器，使用4个带使能端的3-8译码器和一个2-4译码器.