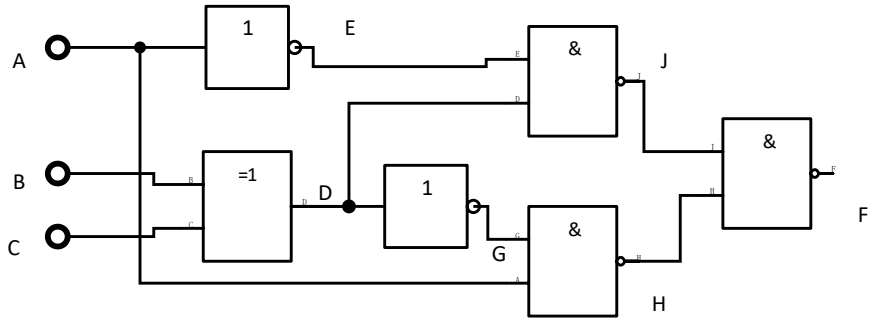
模拟电路与数字电路

第九章作业

9.2 分析如图所示组合电路的逻辑功能。



$F=\overline{JH}=\bar{J}+\bar{H}=ED+AG=\bar{A}(B\oplus C)+A\bar{D}=\bar{A}(B\oplus C)+A\overline{B\oplus C}=A\oplus B\oplus C$

功能为 3 输入异或门。

9.3 试用与非门设计一个 8421BCD 码 N 的监视器。如果 N>=4，监视器输出为 1，否则为 0。

解：真值表

N=ABCD				Y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
-	-	-	-	-

卡诺图：

ABCD	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	-	-	-	-
10	1	1	-	-

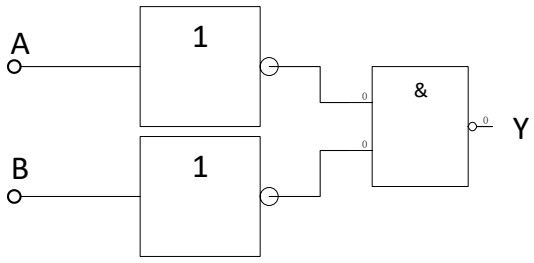
B

A

逻辑表达式

$Y=A+B=\overline{\bar{A}\bar{B}}$

逻辑图：

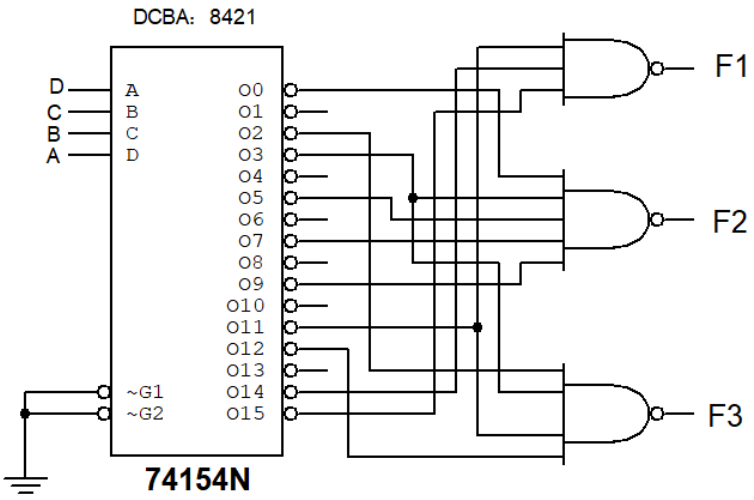


9.8 试用一片 4-16 线译码器 74154 和适当的门电路实现一下多输出逻辑函数。

（1）$F_1=\bar{A}\bar{B}C+A\bar{C}D=\bar{A}\bar{B}C\bar{D}+\bar{A}\bar{B}CD+A\bar{B}\bar{C}D+AB\bar{C}D=\Sigma m(2,3,9,13)$

$F_2=\Sigma m(1,3,5,7,9)$

$F_3=\Pi M(0,1,4\sim10,13\sim15)=\Sigma m(2,3,11,12)$



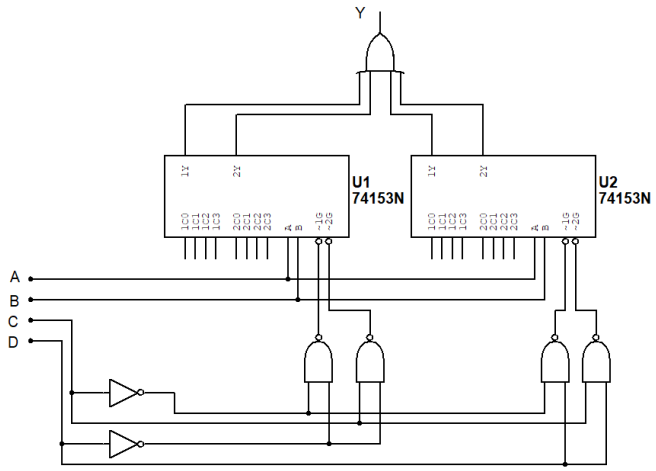
(2)$F_1 = \Pi M(1,3,4,5,7,8,9,10,12,14) = \Sigma m(0,2,6,11,13,15)$

$F_2 = \Sigma m(2,7,10,13)$

$F_3 = BC\bar{D} + A\bar{B}D = ABC\bar{D} + \bar{A}BC\bar{D} + A\bar{B}\bar{C}D + A\bar{B}CD = \Sigma m(6,9,11,14)$

图略

9.11 试用两片双 4 选 1 数据选择器 74153 和少许门电路，接成一个 16 选 1 数据选择器。



9.13 试用 4 选 1 数据选择器实现下面各函数

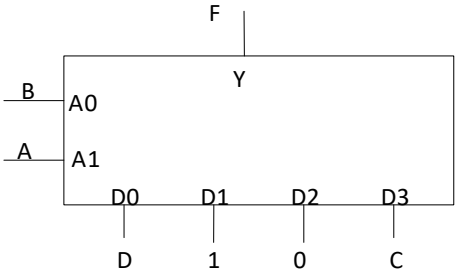
（3）$F(A,B,C,D) = \Sigma m(1,3,4,5,14,15) + \Sigma\, d(6,7,10,11,12)$

解：卡诺图

ABCD	00	01	11	10
00	0	1	1	0
01	1	1	X	X
11	X	0	1	1
10	0	0	X	X

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

$F = \bar{A}\bar{B}D + \bar{A}B + ABC$

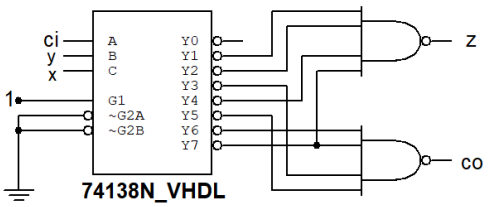


9.14 试用 3 线-8 线译码器 74138 实现一位全加器。

解：全加器真值表。输入 x,y,ci 输出本位和 z,co。

X	Y	Ci	Z	co
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

z=m1+m2+m4+m7，co=m3+m5+m6+m7



9.16 试用 1 片双 4 选 1 数据选择器 74153 和少量门电路实现一位全减器。

解：全减器真值表。被减数 x,减数 y，借位输入 bi,本位差，借位输出 bo

X	Y	bi	Z	bo
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

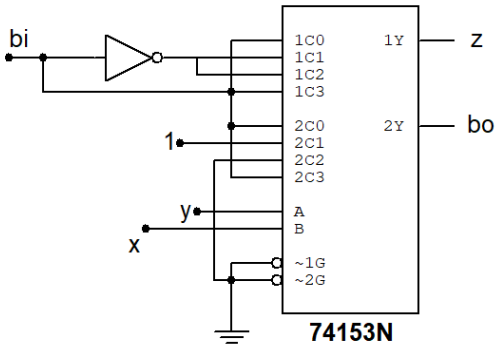
z=m1+m2+m4+m7=

$\bar{x}\bar{y}b_i + \bar{x}y\bar{b_i} + x\bar{y}\bar{b_i} + xyb_i$

bo=m1+m2+m3+m7=

$\bar{x}\bar{y}b_i + \bar{x}y\bar{b_i} + \bar{x}yb_i + xyb_i$

$= \bar{x}\bar{y}b_i + \bar{x}y + xyb_i$



9.17 试写出题图 9-17 所示电路的输出 F 的最小项之和表达式。

$s = a \oplus b \oplus 1 = a \oplus \left(\bar{b} \cdot 1 + b \cdot \bar{1}\right) = a \oplus \bar{b} = \bar{a}\bar{b} + ab$

$CO = (a \oplus b)CI + ab = \bar{a}b + a\bar{b} + ab = a + b$

$S \oplus cO = \left(\bar{a}\bar{b} + ab\right) \oplus (a + b) = \left(\bar{a}\bar{b} + ab\right) \oplus \overline{\bar{a}\bar{b}} = \left(\bar{a}\bar{b} + ab\right)\left(\bar{a}\bar{b}\right) + \overline{\bar{a}\bar{b} + ab} \cdot \overline{\bar{a}\bar{b}}$

$= \bar{a}\bar{b} + \overline{\bar{a}\bar{b} + ab + \bar{a}\bar{b}} = \bar{a}\bar{b} + \overline{\bar{a}\bar{b} + ab} = \bar{a}\bar{b} + \overline{\bar{a}\bar{b}} \cdot \bar{a}b = \bar{a}\bar{b} + \overline{ab} = \bar{a}\bar{b} + \bar{a} + \bar{b} = \bar{a} + \bar{b} = \overline{ab}$

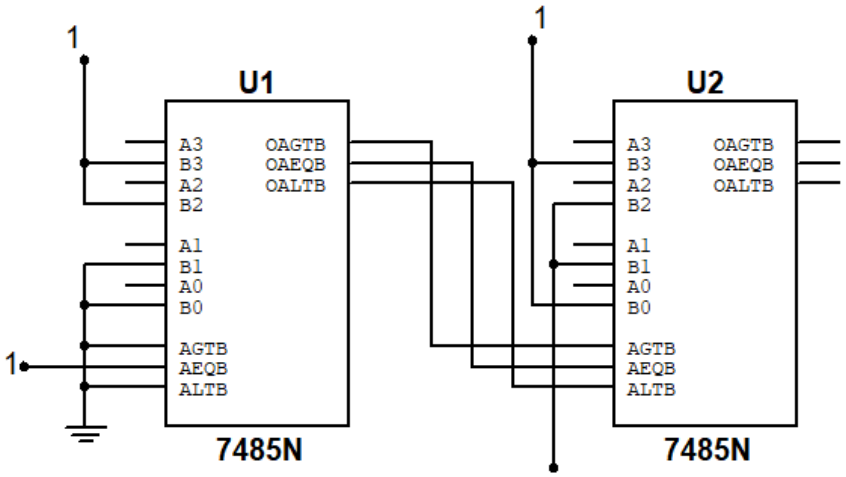
$D_0 = ab,\ D_1 = \overline{ab},\ D_2 = a + b,\ D_3 = \overline{\overline{a + b}} = \bar{a}\bar{b}$

$F = ab\bar{c}\bar{d} + \left(\bar{a} + \bar{b}\right)\bar{c}d + (a + b)c\bar{d} + \bar{a}\bar{b}cd = ab\bar{c}\bar{d} + \bar{a}\bar{c}d + \bar{b}\bar{c}d + ac\bar{d} + bc\bar{d} + \bar{a}\bar{b}cd$

$F = \Sigma m(12,1,5,1,9,10,14,6,14,3) = \Sigma m(1,3,5,6,9,10,12,14)$

9.20 试用 4 位二进制数值比较器 7485 实现一个判断 8 位二进制数大于、等于或小于 156 的逻辑电路。

解：（156）D=(1001 1100)B


1
U1
A3
B3
A2
B2
A1
B1
A0
B0
AGTB
AEQB
ALTB
OAGTB
OAEQB
OALTB
1
7485N
低四位
1
U2
A3
B3
A2
B2
A1
B1
A0
B0
AGTB
AEQB
ALTB
OAGTB
OAEQB
OALTB
7485N
0
高四位

B=1001 1100