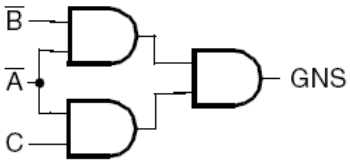
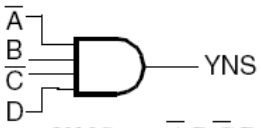
# 第三章布置习题参考解

**3-7**

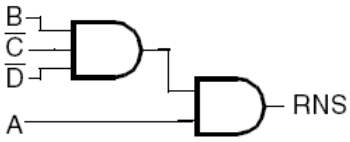
| ABCD | GNS | YNS | RNS | GEW | YEW | REW |
|---|---|---|---|---|---|---|
| 0000 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0001 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0011 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0010 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0110 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0111 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0101 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0100 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1100 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1101 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1111 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1110 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1010 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1011 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1001 | 0 | 0 | 1 | 0 | 1 | 0 |
| 1000 | 0 | 0 | 1 | 0 | 0 | 1 |



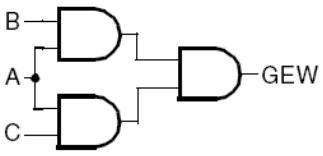

$$GNS = \overline{A}C + \overline{A}\overline{B}$$



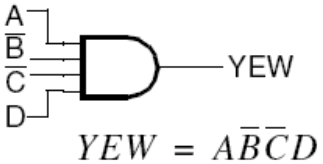

$$YNS = \overline{A}B\overline{C}D$$



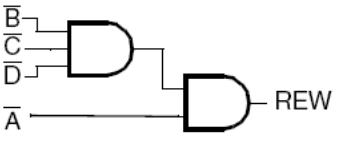

$$RNS = A + B\overline{C}\overline{D}$$




$$GEW = AB + AC$$




$$YEW = A\overline{B}\overline{C}D$$




$$REW = \overline{A} + \overline{B}\overline{C}\overline{D}$$

**3-8**

| A | B | C | S5 | S4 | S3 | S2 | S1 | S0 |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |

S0 = C

S1 = 0

S2=B$\overline{C}$

S3 = $\overline{A}$BC + A$\overline{B}$C

S4 = A$\overline{B}$ + AC

S5 = AB

**3-11**

(a)

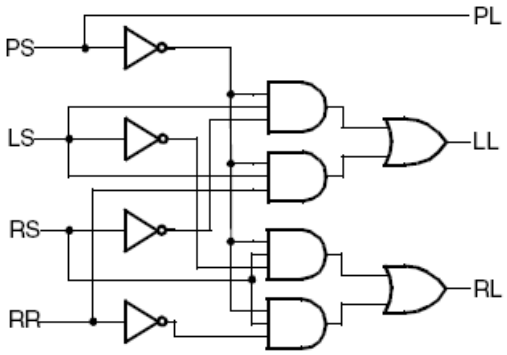
| PS | LS | RS | RR | PL | LL | RL |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 |

$$PL = PS$$

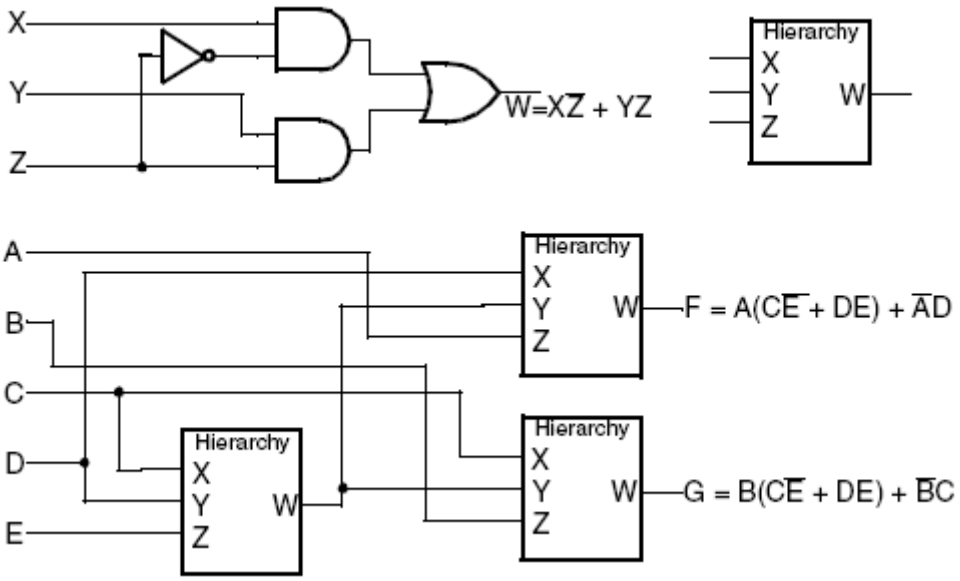
$$LL = \overline{PS}\ LS\ \overline{RS} + \overline{PS}\ LS\ RR$$

$$RL = \overline{PS}\ \overline{LS}\ RS + \overline{PS}\ RS\ \overline{RR}$$

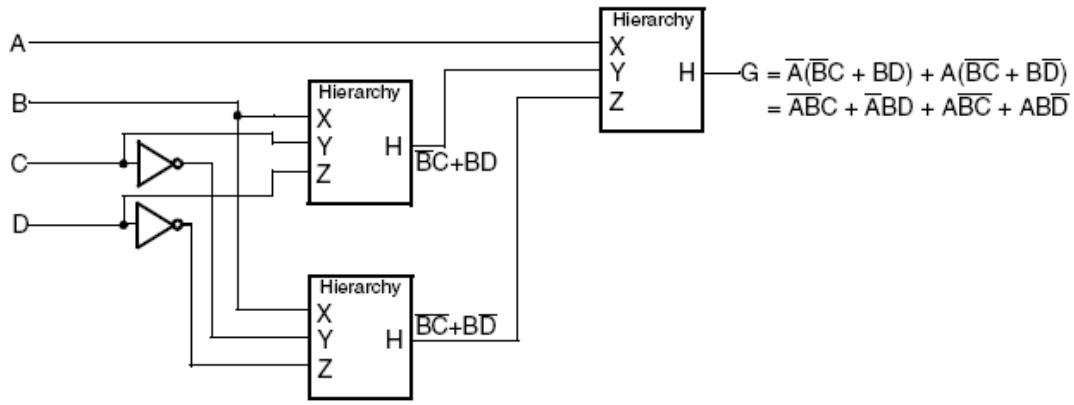
(b)



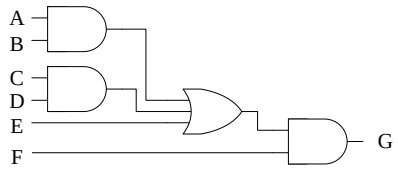

**3-13 一个电路实现下面一对布尔方程：**



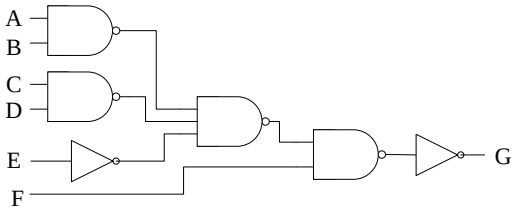
**3-14**




**3-16**



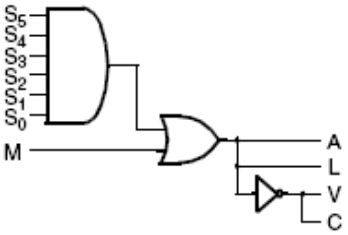

Original circuit



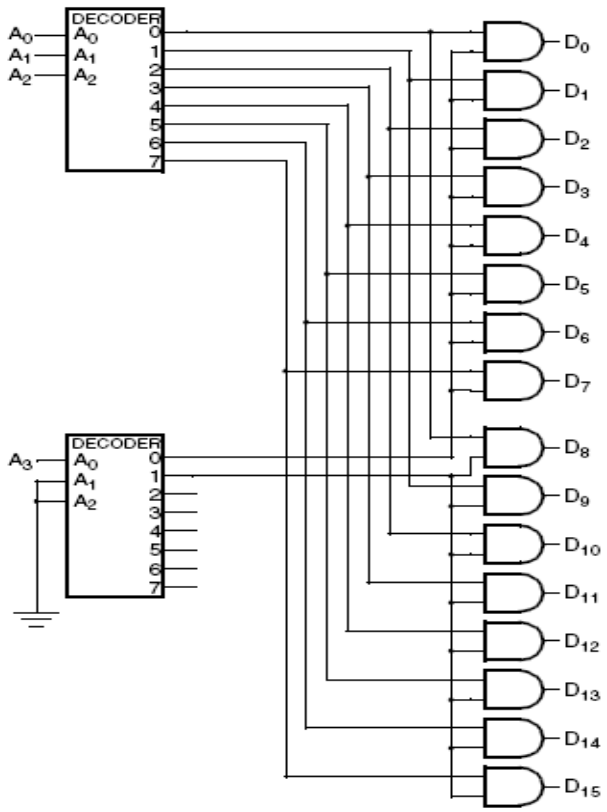

Solution

**3-27**

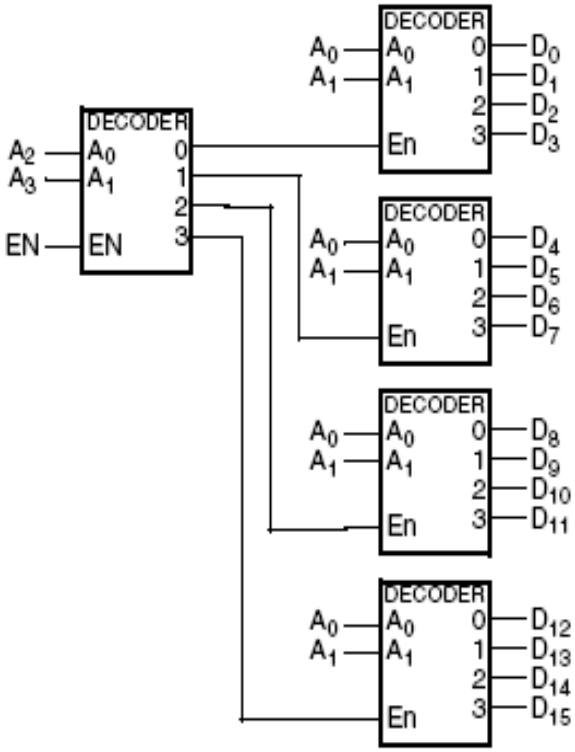
$$A = (S_0 \cdot S_1 \cdot S_2 \cdot S_3 \cdot S_4 \cdot S_5) + M$$
$$L = A$$
$$V = \overline{A} = \overline{(S_0 \cdot S_1 \cdot S_2 \cdot S_3 \cdot S_4 \cdot S_5) + M}$$
$$C = V$$




**3-28**

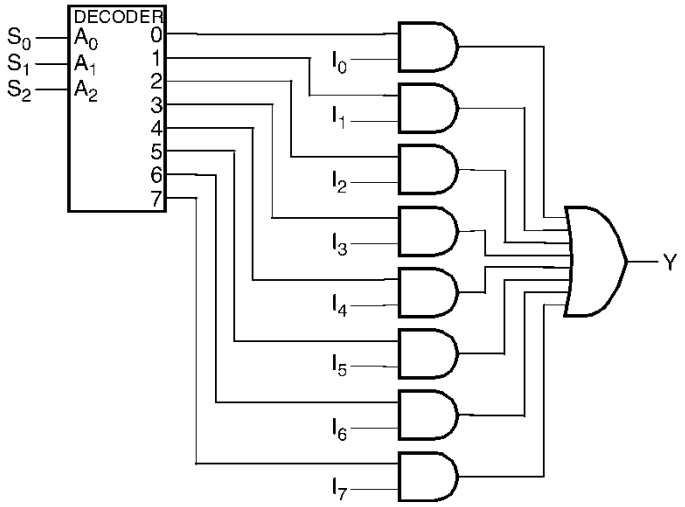

DECODER
A0
A1
A2
0
1
2
3
4
5
6
7
A3
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15

**3-29**

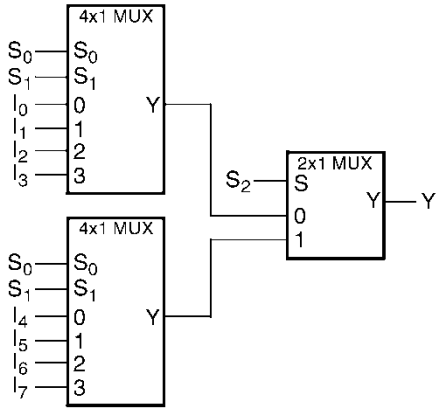

DECODER
A0
A1
A2
A3
EN
En
0
1
2
3
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15

**3-37**

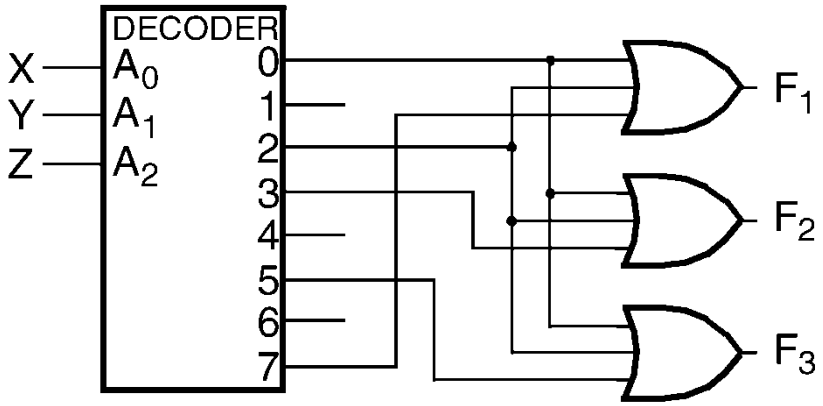
a)




b)

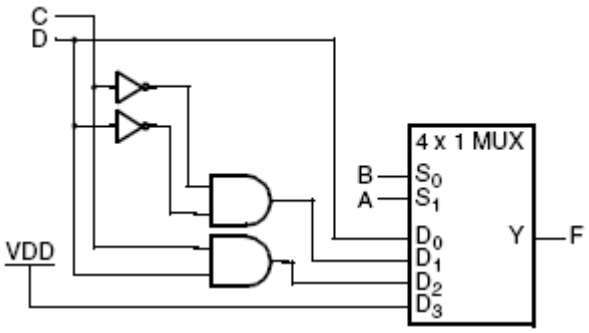



**3-44**




**3-47**

| A | B | C | D | F | |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | 1 | 1 | F=D |
| 0 | 0 | 1 | 0 | 0 | |
| 0 | 0 | 1 | 1 | 1 | |
| 0 | 1 | 0 | 0 | 1 | |
| 0 | 1 | 0 | 1 | 0 | $F=\overline{C}\,\overline{D}$ |
| 0 | 1 | 1 | 0 | 0 | |
| 0 | 1 | 1 | 1 | 0 | |
| 1 | 0 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 1 | 0 | |
| 1 | 0 | 1 | 0 | 0 | F=C D |
| 1 | 0 | 1 | 1 | 1 | |
| 1 | 1 | 0 | 0 | 1 | |
| 1 | 1 | 0 | 1 | 1 | |
| 1 | 1 | 1 | 0 | 1 | F=1 |
| 1 | 1 | 1 | 1 | 1 | |



**3-50** 图 3-58 给出了四位加法器最低位运算的逻辑图。这与集成电路 74283 内部的实现相同。试验证该电路的全加器功能。

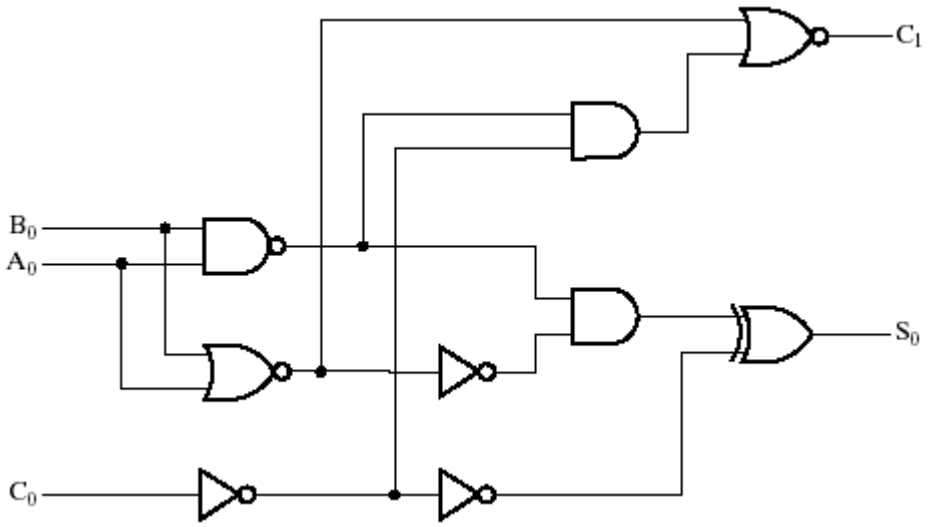
解：

$$C_1 = \overline{T_3 + T_2} = \overline{T_1\bar{C}_0 + T_2} = \overline{\overline{A_0B_0\bar{C}_0} + \overline{A_0 + B_0}} = \overline{(\bar{A}_0 + \bar{B}_0)\bar{C}_0 + \bar{A}_0\bar{B}_0} = (A_0B_0 + C_0)(A_0 + B_0)$$

$$C_1 = A_0B_0 + A_0C_0 + B_0C_0$$

$$S_0 = C_0 \oplus T_4 = C_0 \oplus T_1\bar{T}_2 = C_0 \oplus \overline{A_0B_0}(A_0 + B_0) = C_0 \oplus (\bar{A}_0 + \bar{B}_0)(A_0 + B_0) = C_0 \oplus A_0\bar{B}_0 + \bar{A}_0B_0$$

$$S_0 = A_0 \oplus B_0 \oplus C_0$$




**3-51** 求下列无符号二进制数的反码和补码：**10011100**，**10011101**，**10101000**，**00000000** 和 **10000000**。

| Unsigned | 1001 1100 | 1001 1101 | 1010 1000 | 0000 0000 | 1000 0000 |
|---|---|---|---|---|---|
| 1's Complement | 0110 0011 | 0110 0010 | 0101 0111 | 1111 1111 | 0111 1111 |
| 2's Complement | 0110 0100 | 0110 0011 | 0101 1000 | 0000 0000 | 1000 0000 |

Assume the binary numbers in Problem 3-51 are all signed binary numbers in Signed-Magnitude form

| Signed-Magnitude | 1001 1100 | 1001 1101 | 1010 1000 | 0000 0000 | 1000 0000 |
|---|---|---|---|---|---|
| 1's Complement | 1110 0011 | 1110 0010 | 1101 0111 | 0000 0000 | 1111 1111 |
| 2's Complement | 1110 0100 | 1110 0011 | 1101 1000 | 0000 0000 | 0000 0000 |

**3-52** 求下列无符号二进制数相减的结果，其中减数采用二进制补码表示：

**(a) 11010 - 10001**

a) 11010
+ 01111
01001

**(b) 11110 – 1110**

b) 11110
+ 10010
10000

**(c) 1111110 – 1111110**

c) 1111110
+ 0000010
0000000

**(d) 101001 - 101**

d) 101001
+ 111011
100100

**3-59** 设计一个组合电路来比较两个 4 位二进制数 A、B，判断 B 是否大于 A，这个电路输出为 X，满足：当 A<B 时，X=1；当 A≥B 时，X=0。

**解：**

**1 位比较器：**

| 输入 | | Zi | Yi | Wi |
|---|---|---|---|---|
| Ai | Bi | Ai> Bi | Ai= Bi | Ai< Bi |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 |

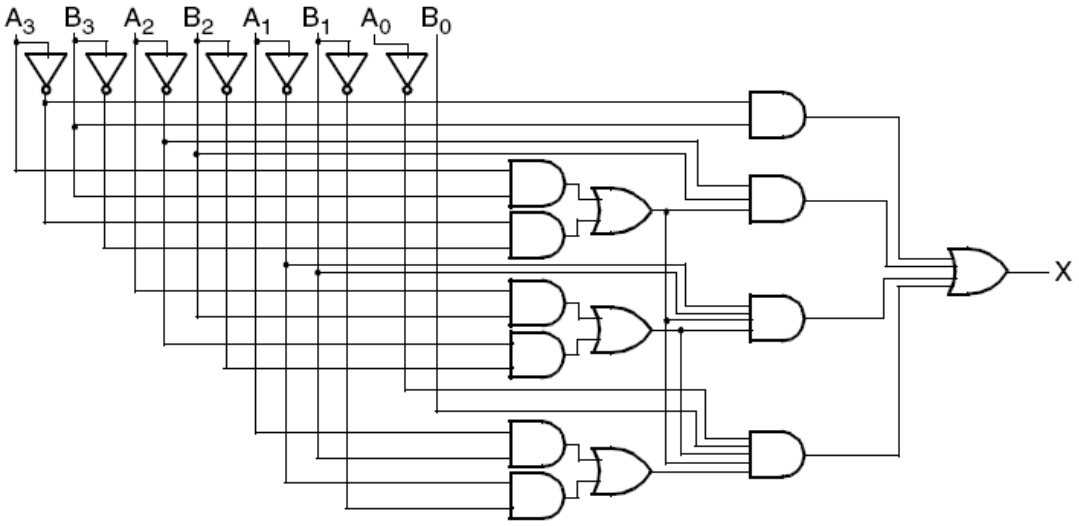
$$A_i > B_i \quad Z_i = A_i\overline{B}_i$$
$$A_i = B_i \quad Y_i = \overline{A_i\overline{B}_i + B_i\overline{A}_i}$$
$$A_i < B_i \quad W_i = B_i\overline{A}_i$$

**4 位处理时从最高位开始逐位比较：**

如果 $A_i < B_i,\ (\overline{A}_iB_i = 1)$ 且所有 $j > i, A_j = B_j\ \ (\overline{A}_j\overline{B}_j + A_jB_j = 1)$，则 **A**<B。

| A3<B3 | A3=B3<br>且 A2<B2 | A3=B3，A2=B2<br>且 A1<B1 | A3=B3，A2=B2，A1=1<br>且 A0<B0 | X |
|---|---|---|---|---|
| 1 | X | X | X | 1 |
| | 1 | X | X | 1 |
| | | 1 | X | 1 |
| | | | 1 | 1 |
| | | | | 0 |

$$X = \overline{A}_3B_3 + (A_3B_3 + \overline{A}_3\overline{B}_3)\overline{A}_2B_2 + (A_3B_3 + \overline{A}_3\overline{B}_3)(A_2B_2 + \overline{A}_2\overline{B}_2)\overline{A}_1B_1$$
$$+ (A_3B_3 + \overline{A}_3\overline{B}_3)(A_2B_2 + \overline{A}_2\overline{B}_2)(A_1B_1 + \overline{A}_1\overline{B}_1)\overline{A}_0B_0$$




解法二：用串行加法器构造电路 A-B，即在 B 上加非门，$C_0$ 接 1，在 $C_4$ 上加非门作为 X。

解法三：用串行加法器构造电路 B-A-1，即在 A 上加非门，$C_0$ 接 0，将 $C_4$ 作为 X。