(a) Design a 2-bit logic circuit.

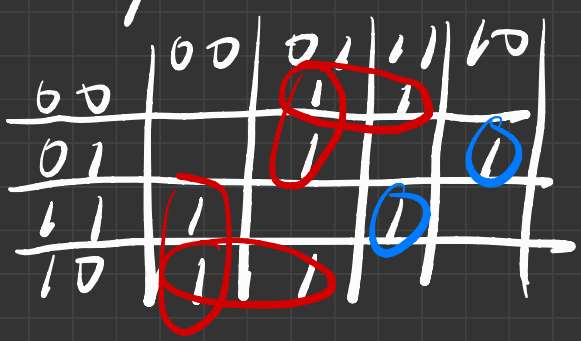
Hint:

$$\begin{array}{r} A_1\ A_0 \\ +\ B_1\ B_0 \\ \hline C_1\ S_1\ S_0 \end{array}$$

A_1	A_0	B_1	B_0	S_1	S_0	C_1
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	1	0	1	0	0
0	0	1	1	1	1	0
0	1	0	0	0	1	0
0	1	0	1	1	0	0
0	1	1	0	1	1	0
0	1	1	1	0	0	1
1	0	0	0	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	0	1
1	0	1	1	0	1	1
1	1	0	0	1	1	0
1	1	0	1	0	0	1
1	1	1	0	0	1	1
1	1	1	1	1	0	1

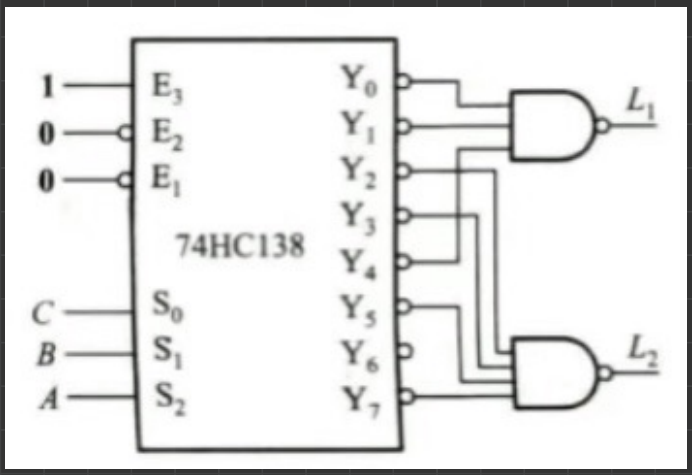
A_1	A_0	B_1	B_0	S_1	S_0	C_1
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	1	0	1	0	0
0	0	1	1	1	1	0
0	1	0	0	0	1	0
0	1	0	1	1	0	0
0	1	1	0	1	1	0
0	1	1	1	0	0	1
1	0	0	0	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	0	1
1	0	1	1	0	1	1
1	1	0	0	1	1	0
1	1	0	1	0	0	1
1	1	1	0	0	1	1
1	1	1	1	1	0	1

A_1A_0 / B_1B_0



$S_1 = A_1\bar{B}_1\bar{B}_0 + \bar{A}_1A_0\bar{B}_1 + \bar{A}_1\bar{A}_0B_0 + \bar{A}_1\bar{B}_1B_0 + A_1A_0B_1B_0 + \bar{A}_1A_0B_1\bar{B}_0$

(b)



$$L_1 = \overline{\bar{Y}_0 \cdot \bar{Y}_1 \cdot \bar{Y}_4} = Y_0 + Y_1 + Y_4$$

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

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

AB\C

AB \ C	0	1
00	1	1
01		
11		
10	1	

$$L_2 = \overline{\bar{Y}_2 \cdot \bar{Y}_3 \cdot \bar{Y}_5 \cdot \bar{Y}_7} = m_2 + m_3 + m_5 + m_7$$

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

AB/C

AB / C	0	1
00		
01	1	1
11	1	1
10		

$$L_2 = \bar{A}B + AC$$

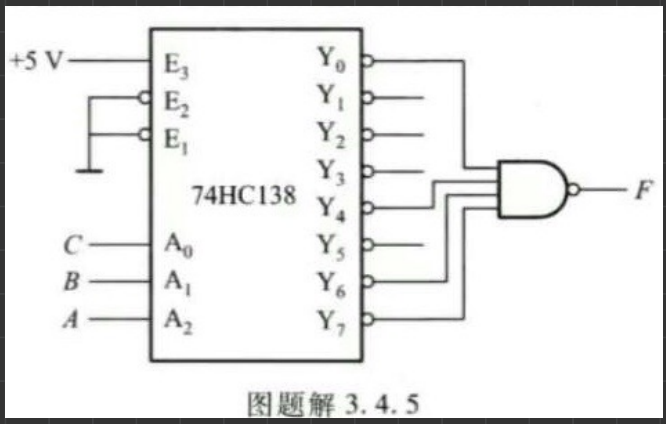
(c) Use 74HC138 to design.

$$F = \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + AB\bar{C} + ABC$$

$$= \overline{\bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + AB\bar{C} + ABC}$$

$$= \overline{\bar{A}\bar{B}\bar{C} \cdot A\bar{B}\bar{C} \cdot AB\bar{C} \cdot ABC}$$

$$= \overline{\bar{Y}_0 \cdot \bar{Y}_4 \cdot \bar{Y}_6 \cdot \bar{Y}_7}$$

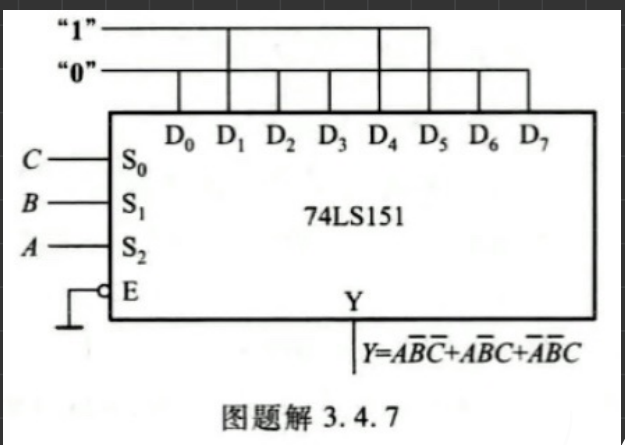


图题解 3.4.5

(d) Use 74LS151 design $Y = A\bar{B}\bar{C} + A\bar{B}C + \bar{A}\bar{B}C$

$$Y = \sum_{i=0}^{7} m_i D_i = m_0 D_0 + m_1 D_1 + \cdots + m_7 D_7$$

$$= A\bar{B}\bar{C} \cdot D_4 + A\bar{B}C \cdot D_5 + \bar{A}\bar{B}C \cdot D_1$$



图题解 3.4.7

(e) Design a half subtractor.

A	B	D	V
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

$D = \bar{A}B + A\bar{B} = A \oplus B$

$V = A\bar{B}$