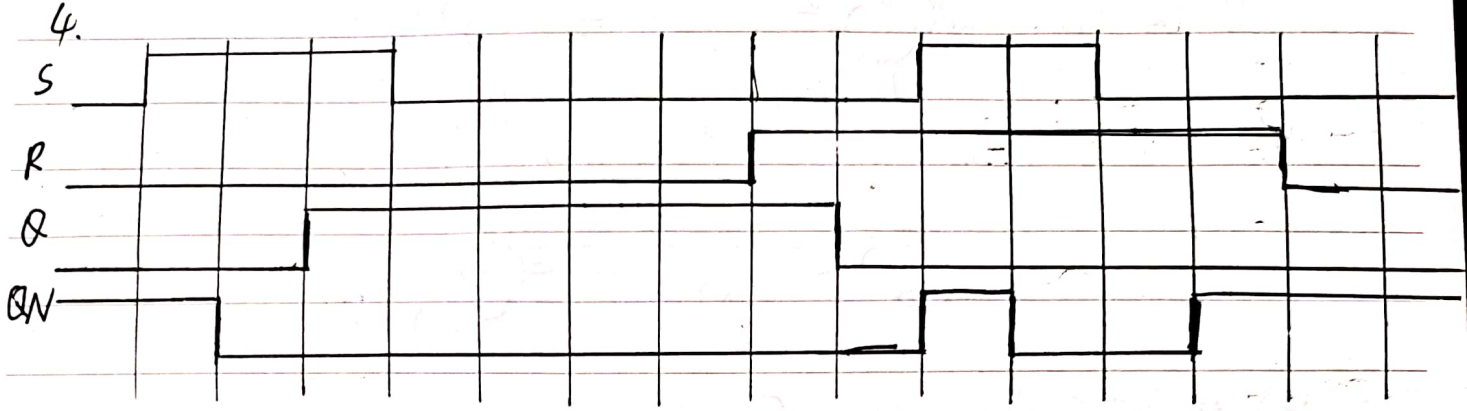
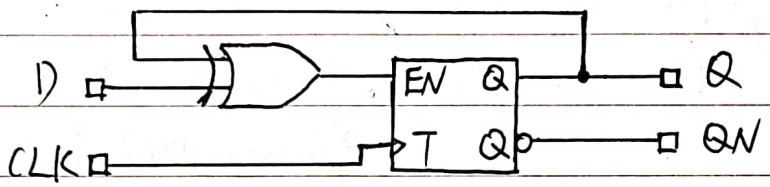
数字电路　第七章作业

4.



6.



8. 触发器与锁存器操作相同，电路相似，区别在于触发器有时钟信号，锁存器没有时钟信号。
因为触发器需要一个外部的时钟信号来驱动，
锁存器需要一个始终为"1"的使能信号来驱动，
所以不能用锁存器来驱动74×74型边沿D触发器
所以无法用一个74×74型边沿D触发器来构造S-R锁存器

12. $D_1 = \overline{Q_1} + Q_2$

$D_2 = X \cdot \overline{Q_2}$

$Z = Q_1 + \overline{Q_2}$

激励/转移表：

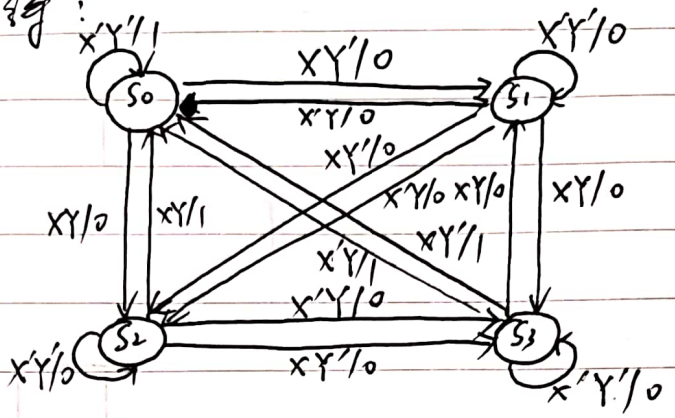
Q_1	Q_2	EN=0	EN=1
0	0	10	11
0	1	10	10
1	0	00	01
1	1	10	10
		Q_1^*	Q_2^*

状态/输出表：

S	EN=0	EN=1	Z
A	C	D	1
B	C	C	0
C	A	B	1
D	C	C	1
	S^*		

15. 由表7.5得：

状态图：



18. 激励方程：$D_0 = Q_1$

$D_1 = Q_2$

$D_2 = (Q_0 \oplus Q_1) \oplus (Q_1 + Q_2)'$

激励/转移表：

Q_2	Q_1	Q_0	Q_2^*	Q_1^*	Q_0^*
0	0	0	1	0	0
0	0	1	0	0	0
0	1	0	1	0	1
0	1	1	0	0	1
1	0	0	0	1	0
1	0	1	1	1	0
1	1	0	1	1	1
1	1	1	0	1	1

状态/输出表：

S	S^*
A	E
B	A
C	B
D	C
E	G
F	H
G	D
H	F

19. 激励方程：$D_1 = X$，$D_2 = (Q_1' \cdot Y') \cdot Q_3'$

$D_3 = Q_2' \cdot Y + Q_1'$

激励/转移表：

Q_1	Q_2	Q_3	XY=00	XY=01	XY=11	XY=10
0	0	0	001	011	101	111
0	0	1	001	001	101	101
0	1	0	001	011	101	110
0	1	1	001	001	101	101
1	0	0	010	011	110	111
1	0	1	000	001	101	101
1	1	0	010	010	110	110
1	1	1	000	000	101	100

$Q_1^*\ Q_2^*\ Q_3^*$

状态/输出表：

S	XY=00	XY=01	XY=11	XY=10
A	B	D	E	H
B	B	B	E	F
C	B	D	E	G
D	B	B	E	F
E	C	D	G	H
F	A	B	E	F
G	C	D	G	G
H	A	A	F	E

S^*

42. 激励方程： $EN_1 = Y$

$EN_2 = X' \cdot Y \cdot Q_1$

输出方程： $Z = X' \cdot Q_2'$

转移方程： $Q_1^* = Y \cdot Q_1' + Y' \cdot Q_1$

$Q_2^* = (X' \cdot Y \cdot Q_1) \cdot Q_2' + (X + Y' + Q_1') \cdot Q_2$.

激励转移表：

Q_1 Q_2	XY 00	01	10	11
00	00,1	10,1	00,0	10,0
01	01,0	11,0	01,0	11,0
10	10,1	01,1	10,0	00,0
11	11,0	00,0	11,0	01,0

$Q_1^* Q_2^*$, Z

状态/输出表：

S	XY 00	01	10	11
A	A,1	C,1	A,0	C,0
B	B,0	D,0	B,0	D,0
C	C,1	B,1	C,0	A,0
D	D,0	A,0	D,0	B,0

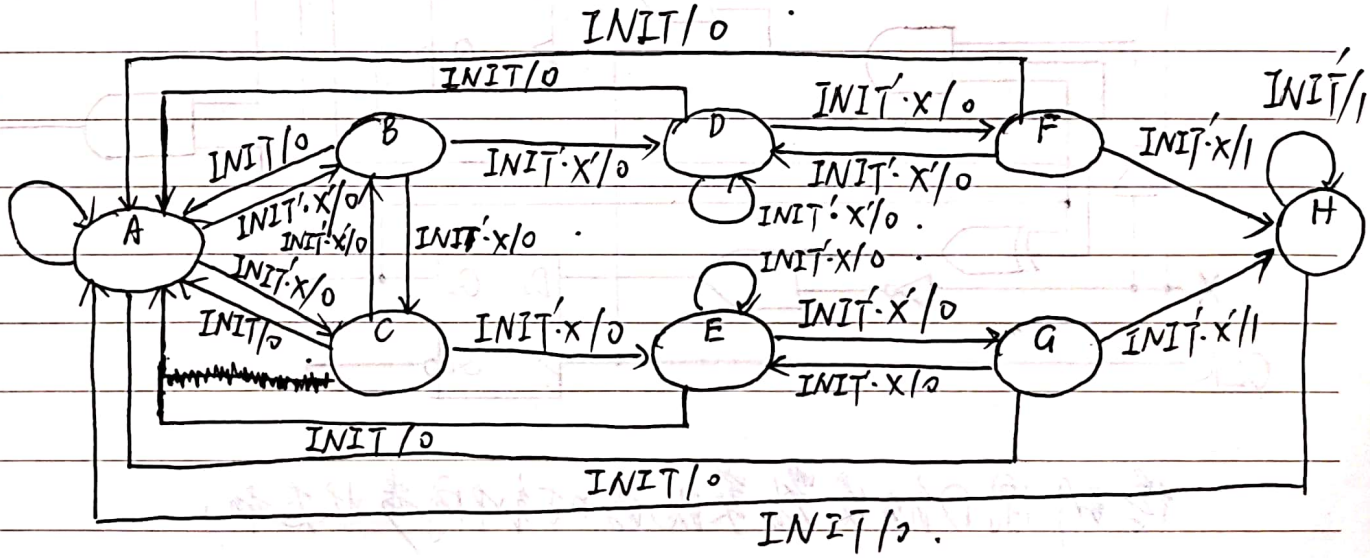
S^*, Z

43. $t_H < t_{CQmin} + t_{Fmin} - t_{hold}$

$\max\{t_{COmax}, t_{DQmax}\} + t_{Fmax} < t_H + t_L$.

$t_{setup} < t_H$.

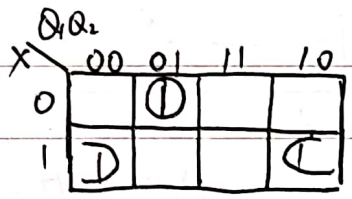
44.



46. 由 X7-46 得：

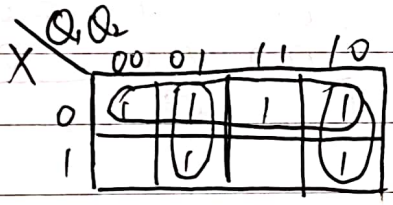
Q_1Q_2	X=0	X=1	Z
00	01	10	0
01	11	01	0
11	01	00	1
10	01	11	0
	$Q_1^*Q_2^*$		

Q_1^*：



$$Q_1^* = X\cdot Q_2' + X'\cdot Q_1'\cdot Q_2$$

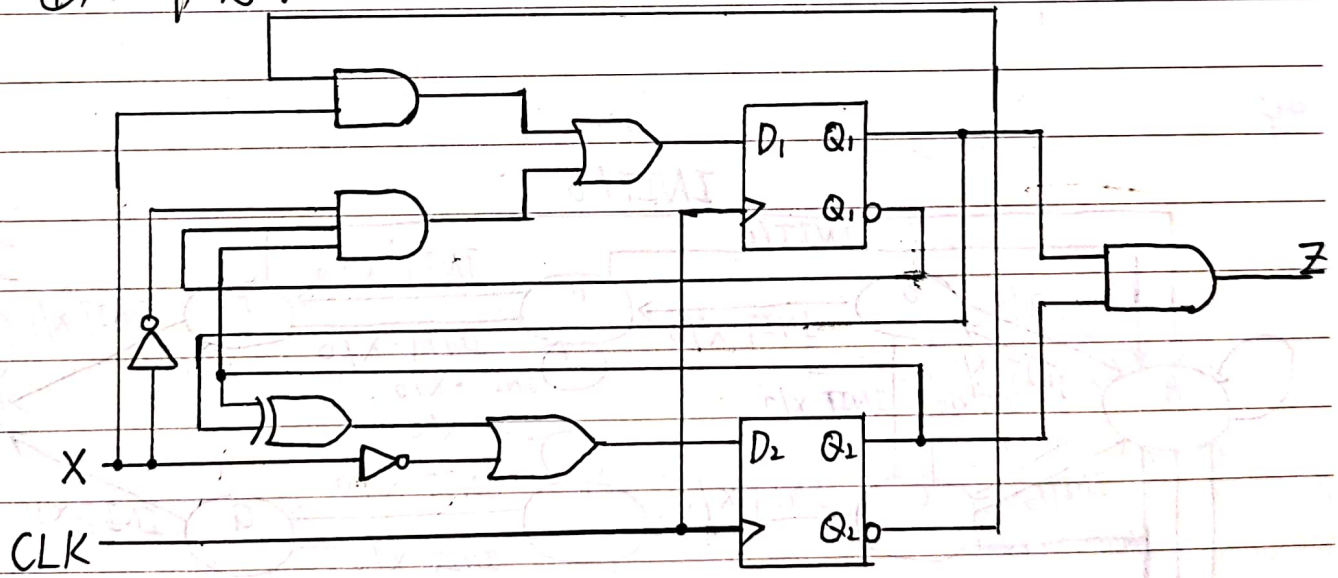
Q_2^*：



$$Q_2^* = X' + Q_1'\cdot Q_2 + Q_1\cdot Q_2'$$
$$= X' + (Q_1 \oplus Q_2).$$

Z：$Z = Q_1\cdot Q_2$.

画出状态机：



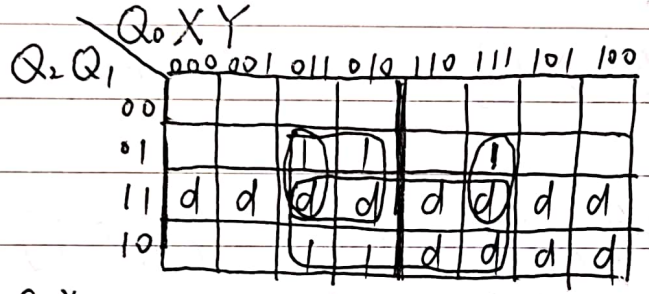
得到用D触发器实现的时钟同步状态机

47. 由表 7-5 和 7-6 得：

$Q_2Q_1Q_0$	XY=00	XY=01	XY=11	XY=10	Z
000	000	001	010	010	0
001	011	011	010	010	0
010	000	001	100	100	0
011	011	011	100	010	1
100	000	011	100	100	1
	$Q_2^*Q_1^*Q_0^*$				

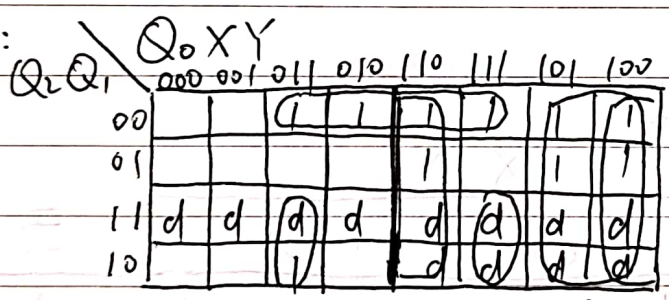
考虑最小成本，加入无关项（未定义状态）

Q_2^*：



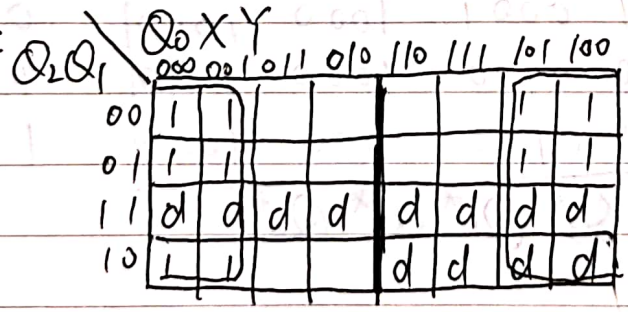
$\therefore Q_2^* = Q_2 \cdot X + Q_1 \cdot Q_0' \cdot X + Q_1 \cdot X \cdot Y$

Q_1^*：



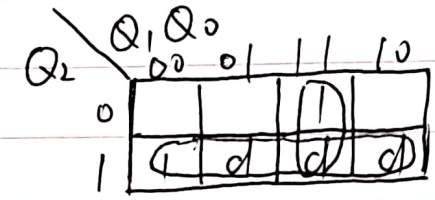
$\therefore Q_1^* = Q_0 \cdot X' + Q_0 \cdot Y' + Q_2' \cdot Q_1' \cdot X + Q_2 \cdot X \cdot Y$

Q_0^*：



$\therefore Q_0^* = X'$

Z：



$\therefore Z = Q_2 + Q_1 \cdot Q_0$

∴ 最小成本激励与输出方程为：

$D_2 = Q_2^* = Q_2 \cdot X + Q_1 \cdot Q_0' \cdot X + Q_1 \cdot X \cdot Y$

$D_1 = Q_1^* = Q_0 \cdot X' + Q_0 \cdot Y' + Q_2' \cdot Q_1' \cdot X + Q_2 \cdot X \cdot Y$

$D_0 = Q_0^* = X'$

$Z = Q_2 + Q_1 \cdot Q_0$

共需要 4个2-输入门，4个3-输入门

在7.4.4节方框中：

共需要 2个2-输入门，1个3-输入门

显然，表7.5中的激励和输出逻辑成本更高.

48. 由表7-5和7-6得：

Q_3 Q_2 Q_1 Q_0	X Y 00	01	11	10	Z
0 0 0 0	0001	0001	0010	0010	0
0 0 0 1	0100	0100	0010	0010	0
0 0 1 0	0001	0001	1000	1000	0
0 1 0 0	0100	0100	1000	0010	1
1 0 0 0	0001	0100	1000	1000	1
	Q_3^* Q_2^* Q_1^* Q_0^*				

画出 Q_3^*、Q_2^*、Q_1^*、Q_0^* 的卡诺图后，可得：

$Q_3^* = Q_3'\cdot Q_2\cdot Q_1'\cdot Q_0'\cdot X\cdot Y + Q_3\cdot Q_2'\cdot Q_1'\cdot Q_0'\cdot X + Q_3'\cdot Q_2'\cdot Q_1\cdot Q_0'\cdot X$

$Q_2^* = Q_3'\cdot Q_2\cdot Q_1'\cdot Q_0'\cdot X' + Q_3\cdot Q_2'\cdot Q_1'\cdot Q_0'\cdot X'\cdot Y + Q_3'\cdot Q_2'\cdot Q_1'\cdot Q_0\cdot X'$

$Q_1^* = Q_3'\cdot Q_2'\cdot Q_1'\cdot X + Q_3'\cdot Q_2'\cdot Q_0'\cdot X\cdot Y'$

$Q_0^* = Q_2'\cdot Q_1'\cdot Q_0'\cdot X'\cdot Y' + Q_3'\cdot Q_2'\cdot Q_0'\cdot X'$

$Z = Q_3'\cdot Q_2\cdot Q_1'\cdot Q_0 + Q_3\cdot Q_2'\cdot Q_1'\cdot Q_0'$

∴ 激励和输出方程为：

$D_3 = Q_3'\cdot Q_2\cdot Q_1'\cdot Q_0'\cdot X\cdot Y + Q_3\cdot Q_2'\cdot Q_1'\cdot Q_0'\cdot X + Q_3'\cdot Q_2'\cdot Q_1\cdot Q_0'\cdot X$

$D_2 = Q_3'\cdot Q_2\cdot Q_1'\cdot Q_0'\cdot X' + Q_3\cdot Q_2'\cdot Q_1'\cdot Q_0'\cdot X'\cdot Y + Q_3'\cdot Q_2'\cdot Q_1'\cdot Q_0\cdot X'$

$D_1 = Q_2'\cdot Q_1'\cdot Q_0'\cdot X'\cdot Y' + Q_3'\cdot Q_2'\cdot Q_0'\cdot X'$

$D_0 = Q_2'\cdot Q_1'\cdot Q_0'\cdot X'\cdot Y' + Q_3'\cdot Q_2'\cdot Q_0'\cdot X'$

$Z = Q_3'\cdot Q_2\cdot Q_1'\cdot Q_0' + Q_3\cdot Q_2'\cdot Q_1'\cdot Q_0'$

共需要：2个6-输入门、6个5-输入门，2个4-输入门

在74194中：

共需要：2个2-输入门、1个3-输入门

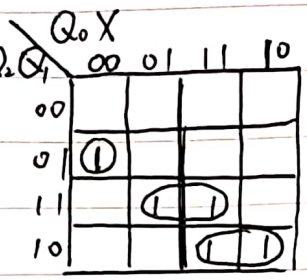
显然表7.5中的激励和输出选择成本更高。

5.4 由表7-11得：

$Q_2Q_1Q_0$	X=0	X=1
000	001,01	000,00
001	001,00	011,01
011	001,00	010,01
010	110,01	000,00
110	001,00	111,01
111	001,00	101,01
101	110,00	100,01
100	001,11	000,00

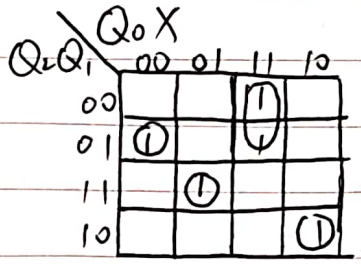
$Q_2^*Q_1^*Q_0^*$, UNLK HINT

Q_2^*：



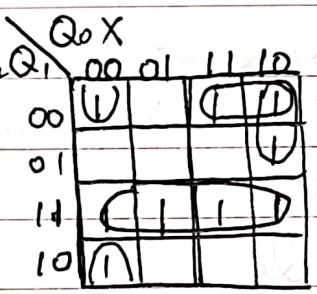
$$Q_2^* = Q_2' \cdot Q_1 \cdot Q_0' \cdot X' + Q_2 \cdot Q_1 \cdot X + Q_2 \cdot Q_1' \cdot Q_0$$

Q_1^*：



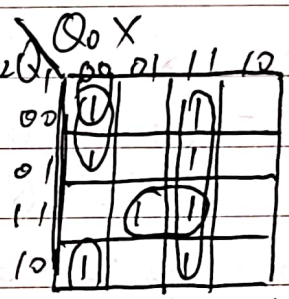
$$Q_1^* = Q_2' \cdot Q_1 \cdot Q_0' \cdot X + Q_2 \cdot Q_1 Q_0' \cdot X + Q_2 \cdot Q_1' \cdot Q_0 \cdot X' + Q_2' \cdot Q_0 \cdot X$$

Q_0^*：



$$Q_0^* = Q_1' \cdot Q_0' \cdot X' + Q_2 \cdot Q_1 + Q_2' \cdot Q_1' \cdot Q_0 + Q_2' \cdot Q_0 \cdot X'$$

HINT：



$$HINT = Q_1' \cdot Q_0' \cdot X' + Q_2' \cdot Q_0' \cdot X' + Q_2 \cdot Q_1 \cdot X + Q_0 \cdot X$$

UNLK：$Q_2 \cdot Q_1' \cdot Q_0' \cdot X'$

通过与教材中的方程，可知：成本相同

都需要5个4-输入门、9个3-输入门、2个2-输入门.