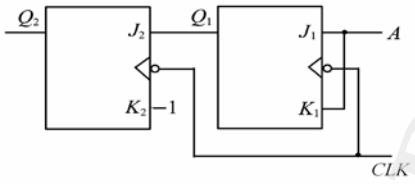
第六章 时序电路 作业

6-2 分析题图 6-2 所示的同步时序电路，画出状态图。



题图 6-2

解：各触发器的状态方程：

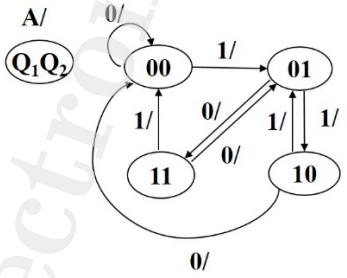
$J_1 = K_1 = A$， $J_2 = Q_1^n$， $K_2 = 1$， $Q_2^{n+1} = Q_1^n \overline{Q_2^n}$， $Q_1^{n+1} = A \oplus Q_1^n$

写出状态表，根据状态表画出状态图。

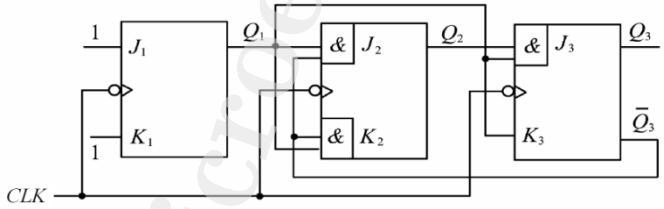
状态表

A	Q_2^n	Q_1^n	Q_2^{n+1}	Q_1^{n+1}
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	1
1	0	0	0	1
1	0	1	1	0
1	1	0	0	1
1	1	1	0	0

状态图



6-3 分析题图 6-3 所示的同步时序电路，画出状态图和波形图。



题图 6-3

解：各触发器的状态方程：

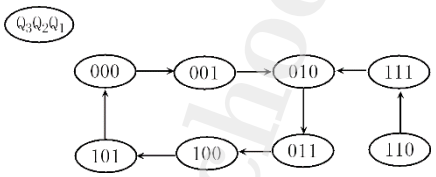
$J_1 = K_1 = T_1 = 1$， $J_2 = K_2 = Q_1^n \overline{Q_3^n} = T_2$， $J_3 = Q_2^n Q_1^n$， $K_3 = Q_1^n$

$Q_3^{n+1} = J_3 \overline{Q_3^n} + \overline{K_3} Q_3^n = Q_2^n Q_1^n \overline{Q_3^n} + \overline{Q_1^n} Q_3^n$

$Q_2^{n+1} = T_2 \oplus Q_2^n = Q_1^n \overline{Q_3^n} \oplus Q_2^n$

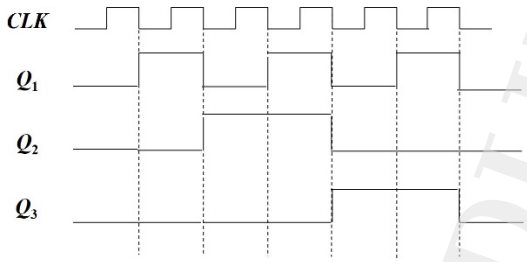
$Q_1^{n+1} = T_1 \oplus Q_1^n = 1 \oplus Q_1^n = \overline{Q_1^n}$

由状态表得到状态图



状态表

Q_3^n	Q_2^n	Q_1^n	Q_3^{n+1}	Q_2^{n+1}	Q_1^{n+1}
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	1	0	1
1	0	1	0	0	0
1	1	0	1	1	1
1	1	1	0	1	0

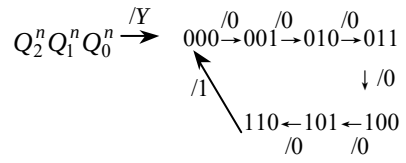


波形图

6-8 设计一个七进制的加法器，规则是逢七进一，并产生一个进位。

解： 写出状态图。因需用 3 位二进制代码，选用 3 个 *CLK* 下降沿触发的 JK 触发器，分别用 FF_0、FF_1、FF_2 表示。时钟方程是 $CLK_0 = CLK_1 = CLK_2 = CLK$

排列顺序：



Q_0^n \ $Q_2^nQ_1^n$	00	01	11	10
0	0	0	1	0
1	0	0	×	0

$Y = Q_1^nQ_2^n$

Y 的卡诺图

Q_0^n \ $Q_2^nQ_1^n$	00	01	11	10
0	1	1	0	1
1	0	0	×	0

(a) Q_0^{n+1} 的卡诺图

Q_0^n \ $Q_2^nQ_1^n$	00	01	11	10
0	0	1	0	0
1	1	0	×	1

(b) Q_1^{n+1} 的卡诺图

Q_0^n \ $Q_2^nQ_1^n$	00	01	11	10
0	0	0	0	1
1	0	1	×	1

(c) Q_2^{n+1} 的卡诺图

化简卡诺图得到：

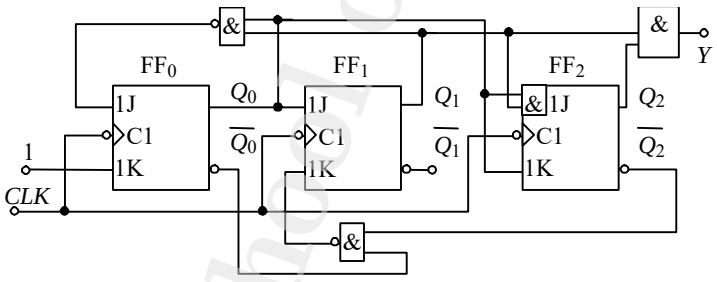
$$\begin{cases} Q_0^{n+1} = \overline{Q}_2^n\overline{Q}_0^n + \overline{Q}_1^n\overline{Q}_0^n \\ \quad\quad = \overline{Q_2^nQ_1^n}\,\overline{Q}_0^n + \overline{1}Q_0^n \\ Q_1^{n+1} = Q_0^n\overline{Q}_1^n + \overline{Q}_2^n\overline{Q}_0^nQ_1^n \\ Q_2^{n+1} = Q_1^nQ_0^n\overline{Q}_2^n + \overline{Q}_1^nQ_2^n \end{cases}$$

与 JK 触发器的特征方程比较得到：

$$Q^{n+1} = J\overline{Q}^n + \overline{K}Q^n$$

$$\begin{cases} J_0 = \overline{Q_2^nQ_1^n}\ 、\ K_0 = 1 \\ J_1 = Q_0^n\ 、\ K_1 = \overline{\overline{Q}_2^n\overline{Q}_0^n} \\ J_2 = Q_1^nQ_0^n\ 、\ K_2 = Q_1^n \end{cases}$$

将无效状态 111 带入状态方程计算：

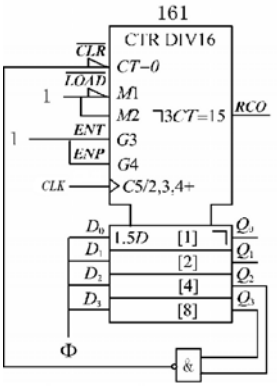


$$\begin{cases} Q_0^{n+1} = \overline{Q_2^nQ_1^n}\,\overline{Q}_0^n + \overline{1}Q_0^n = 0 \\ Q_1^{n+1} = Q_0^n\overline{Q}_1^n + \overline{Q}_2^n\overline{Q}_0^nQ_1^n = 0 \\ Q_2^{n+1} = Q_1^nQ_0^n\overline{Q}_2^n + \overline{Q}_1^nQ_2^n = 0 \end{cases}$$

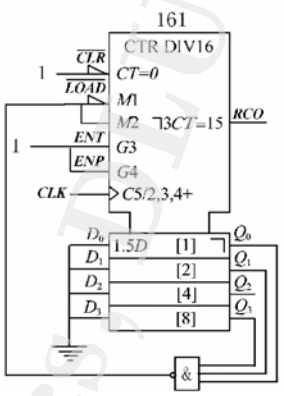
可见 111 的次态是有效状态 000，电路能够自启动。

6.12 试用 74LS161 分别用异步清零法和同步置数法实现模 12 加法计数器。

解：

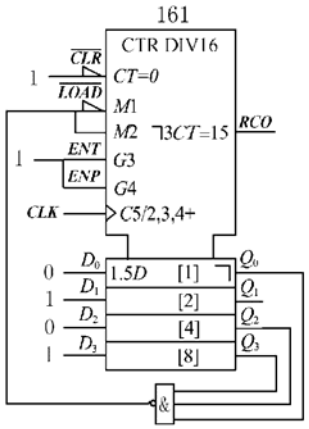


异步清零法

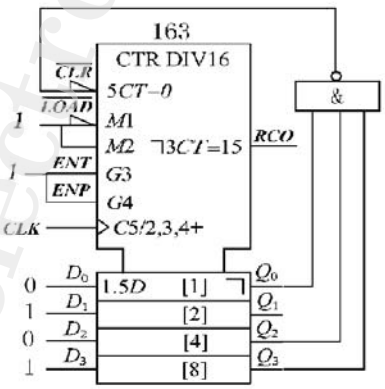


同步置数法

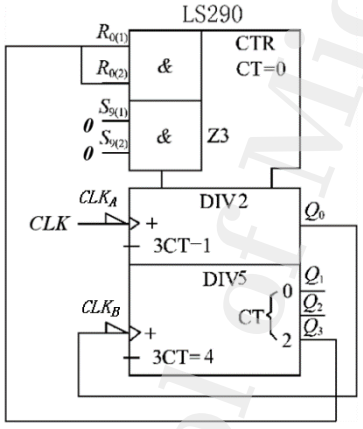
6.15 分析如题图 6.15 所示的各芯片功能，分别画出状态图。



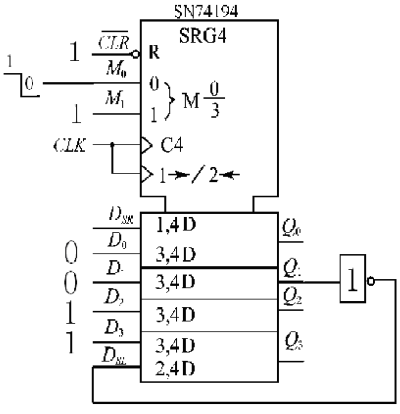
(a)



(b)



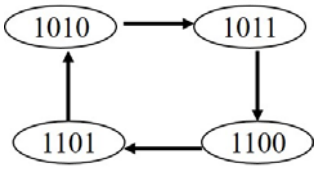
(c)



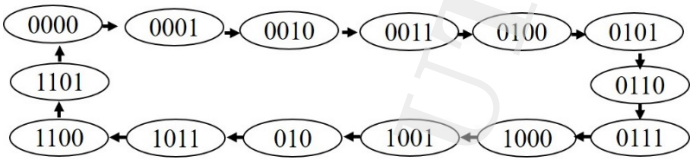
(d)

题图 6.15

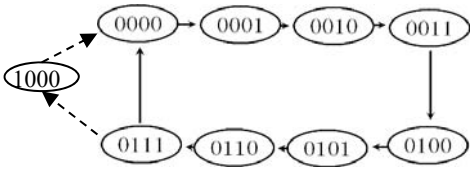
解：



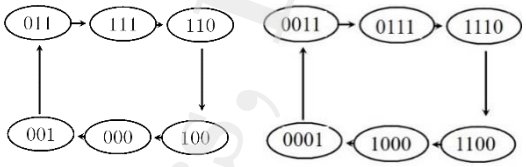
（a）模 4



（b）模 14

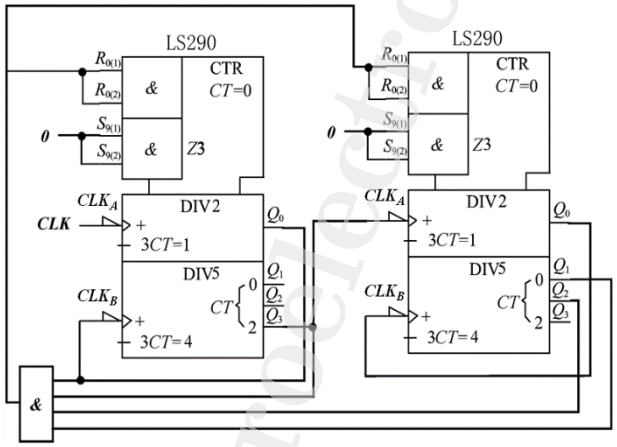


（c）模 8



（d）模 6

6.19 请指出 74290 如题图 6.19 所示电路图的模值为多少？



题图 6.19

解： 模 69