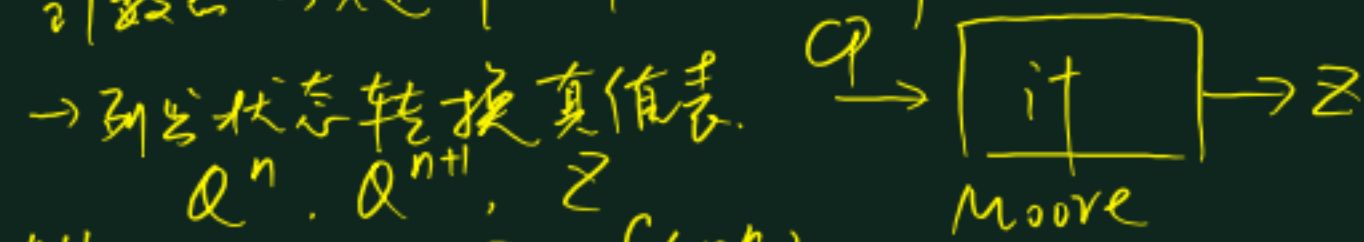


# 时序电路的设计

## 1. 确定状态转换图

计数器  $\rightarrow$   $X$  进制  $\rightarrow$   $X$  个状态  $\rightarrow$  无多余状态化简, 无状态分配, 编码



## 2. 状转真 $\Rightarrow Q^{n+1} \Rightarrow$ 驱 (?)

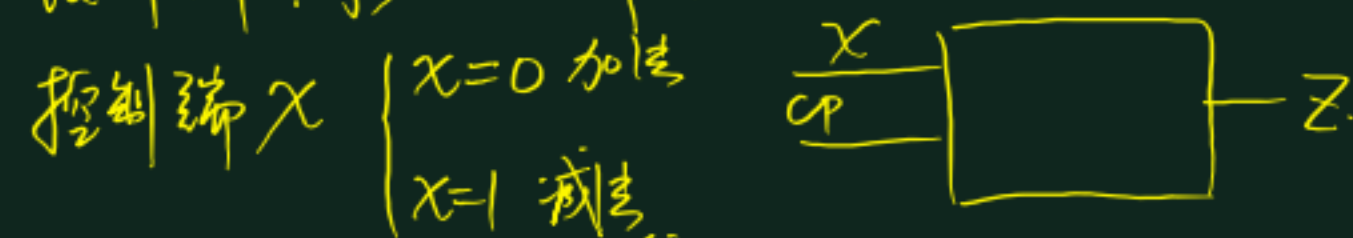
状转真加一列激励

通过激励  $\rightarrow$  激励方程  $\rightarrow Q^{n+1}$

状转真存在无关项  $\rightarrow$  计算  $Q^{n+1} = ? \rightarrow$  判断是否可自启动

## 3. 画图 (驱, 输出)

设计一个同步四进制可逆计数器



输出  $Z = 1$   $\begin{cases} \text{加: 进位} \\ \text{减: 借位} \end{cases}$

$Q_3^n Q_2^n Q_1^n Q_0^n$	$Q_3^{n+1} Q_2^{n+1} Q_1^{n+1} Q_0^{n+1}$	$Z$	$w_3 w_2 w_1 w_0$
0 0 0 0	0 0 0 1	0	Y Y
0 0 0 1	0 0 1 0	0	Y Y
0 0 1 0	0 0 1 1	0	Y Y
0 0 1 1	0 1 0 0	0	Y S
0 1 0 0	0 1 0 1	0	Y S
0 1 0 1	0 1 1 0	0	Y S
0 1 1 0	0 1 1 1	0	Y S
0 1 1 1	1 0 0 0	0	S R

$Q_3^n Q_2^n$	$Q_1^n Q_0^n$	$w_3$	$w_2$	$w_1$	$w_0$
00	00	Y	Y	Y	Y
00	01	Y	Y	S	Y
01	00	Y	Y	S	Y
01	01	Y	Y	S	Y
11	00	R	X	X	X
11	01	R	X	X	X
10	00	S	S	S	S
10	01	S	S	S	S

$$J_3 = Q_2^n \cdot Q_1^n \cdot Q_0^n$$

$$K_3 = Q_2^n$$

$$J: S \rightarrow 1, R, S \rightarrow X, r \rightarrow 0$$

$$K: R \rightarrow 1, S, r \rightarrow X, s \rightarrow 0$$

$$D: S, s \rightarrow 1, R, r \rightarrow 0$$

$$T: S, R \rightarrow 1, s, r \rightarrow 0$$

$X Q_1 Q_0^n$	$Q_1^{n+1} Q_0^{n+1}$	$Z$	$W_1 W_0$
0 0 0	0 1	0	S R
0 0 1	1 0	0	$\bar{S}$ $\bar{R}$
0 1 0	1 1	0	$\bar{S}$ $\bar{R}$
0 1 1	0 0	1	R R
1 0 0	1 1	0	$\bar{S}$ $\bar{R}$
1 0 1	0 0	0	R R
1 1 0	0 1	0	R $\bar{S}$
1 1 1	1 0	0	S R

$W_1: Q_1^n \rightarrow Q_1^{n+1}$

$Z: Q_1^n Q_0^n$

	00	01	11	10
0	0	0	1	0
1	1	0	0	0

$W_{1X}: Q_1^n Q_0^n$

	00	01	11	10
0	R	$\bar{S}$	R	$\bar{S}$
1	$\bar{S}$	R	$\bar{S}$	R

$J_1 = X Q_0^n + \bar{X} Q_0^n$

$K_1 = X Q_0^n + \bar{X} Q_0^n$

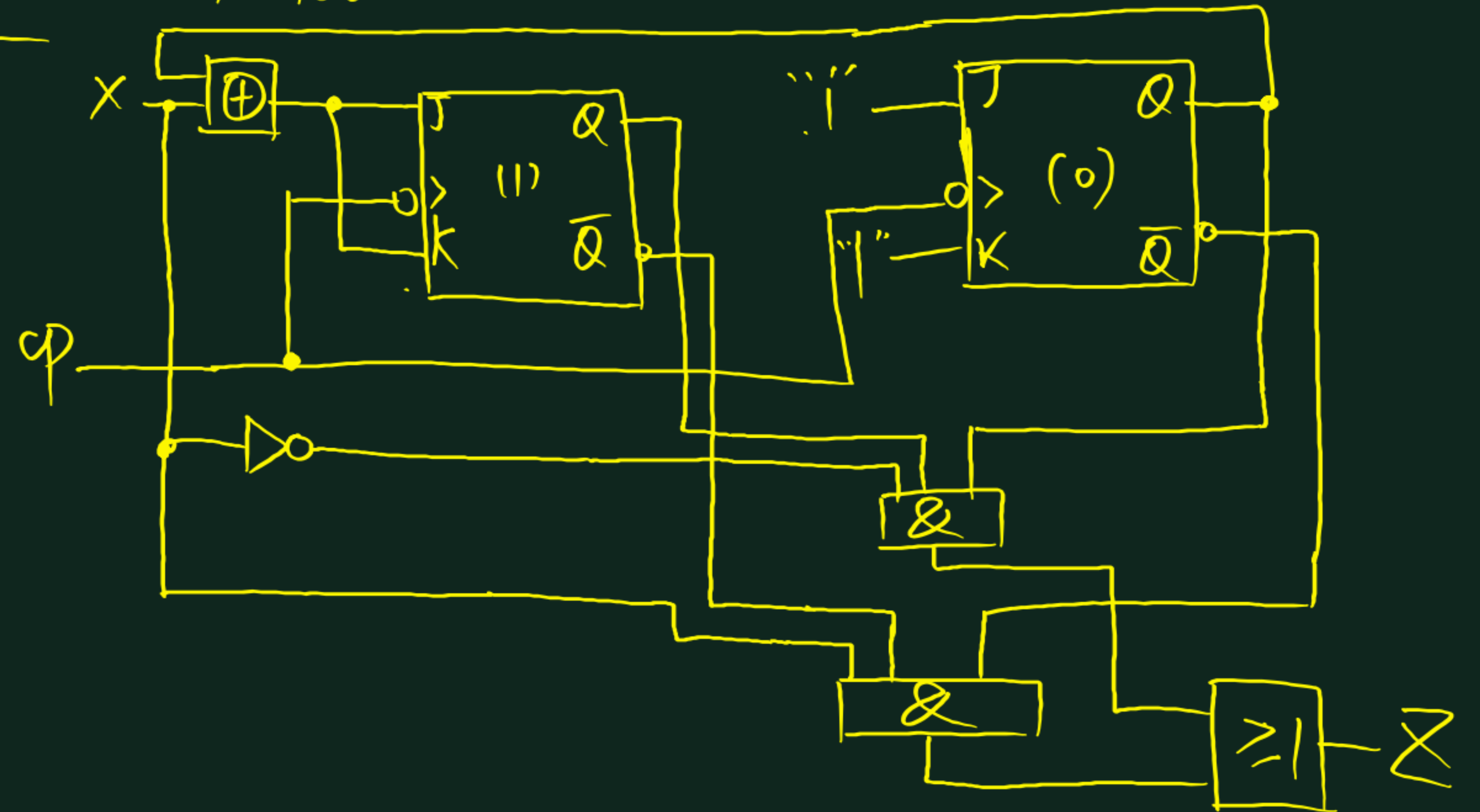
$W_0: Q_1^n Q_0^n$

	00	01	11	10
0	$\bar{S}$	R	R	$\bar{S}$
1	$\bar{S}$	R	R	$\bar{S}$

$J_0 = 1$

$K_0 = 1$

$\therefore Z = \bar{X} Q_1^n Q_0^n + X Q_1^n Q_0^n$





激励表:

$$Q^{n+1} = S + \bar{R}Q^n$$

$$RS = 0$$

0 → 保持  
X → 小写  
1 → 大写

$Q^n$ <del>X</del>	$Q^{n+1}$	S	R	W <del>X</del>
0	0	0	X	R
0	1	1	0	$\bar{S}$
1	0	0	1	R
1	1	X	0	S

每一组 JK →  $Q^{n+1} = ?$

可以不化简:  $Q^{n+1}$  同不同不影响

状态变换  
 $Q_3^n \sim Q_0^n$  →  $Q_3^{n+1} \sim Q_0^{n+1}$

1101 → 0010

1110 → 0010

1111 → 0000

∴ 可自启动