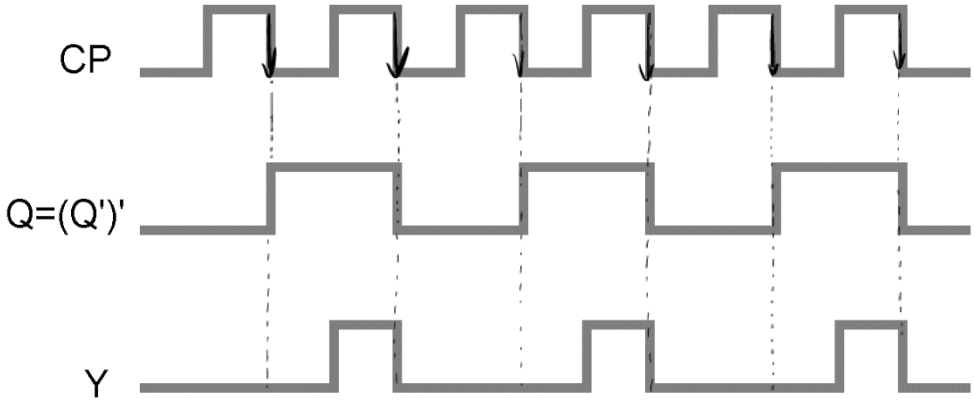
第1题



第2题

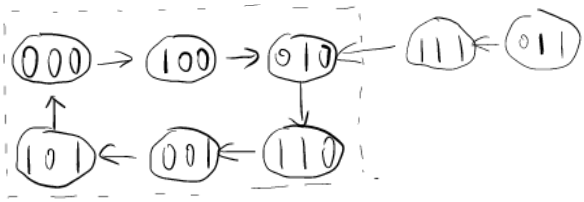
(1) ① 状态方程

$$\begin{cases} Q_0^{n+1} = J_0\overline{Q_0^n} + \overline{K}_0 Q_0^n = \overline{Q_0^n} \\ Q_1^{n+1} = J_1\overline{Q_1^n} + \overline{K}_1 Q_1^n \xrightarrow{J_1 = Q_0^n\overline{Q_2^n}} (Q_0^n\overline{Q_2^n}) \oplus Q_1^n \\ Q_2^{n+1} = J_2\overline{Q_2^n} + \overline{K}_2 Q_2^n \xrightarrow[J_2 = K_2 Q_1^n = Q_0^n Q_1^n]{K_2 = Q_0^n} Q_0^n Q_1^n \overline{Q_2^n} + \overline{Q_0^n} Q_2^n \end{cases}$$

② 状态转换表

现态			次态			序号
Q_0^n	Q_1^n	Q_2^n	Q_0^{n+1}	Q_1^{n+1}	Q_2^{n+1}	
0	0	0	1	0	0	①
0	0	1	1	0	1	⑤
0	1	0	1	1	0	③
0	1	1	1	1	1	
1	0	0	0	1	0	②
1	0	1	0	0	0	⑥
1	1	0	0	0	1	④
1	1	1	0	1	0	

③ 状态转换图 $Q_0Q_1Q_2$



(2) 同步的可自启动的模6计数器

第3题

(1) 状态设定

S_0 初始状态；接收到"0"

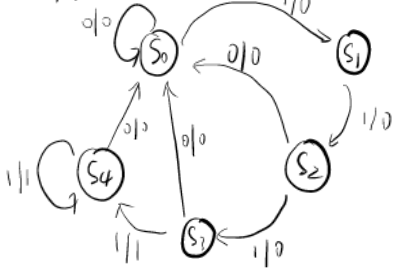
S_1 接收到"1"

S_2 接收到"11"

S_3 接收到"111"

S_4 接收到"1111"或四位以上的"1"

(2) 原始状态图 (Mealy型) X/Z



(3) 原始状态表

Q^n	Q^{n+1}/Z	
	$X=0$	$X=1$
S_0	$S_0/0$	$S_1/0$
S_1	$S_0/0$	$S_2/0$
S_2	$S_0/0$	$S_3/0$
S_3	$S_0/0$	$S_4/1$
S_4	$S_0/0$	$S_4/1$

(4) 简化后状态表

Q^n	Q^{n+1}/Z	
	$X=0$	$X=1$
S_0	$S_0/0$	$S_1/0$
S_1	$S_0/0$	$S_2/0$
S_2	$S_0/0$	$S_3/0$
S_3	$S_0/0$	$S_3/1$

共4个状态，2个D触发器

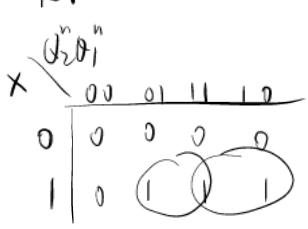
	Q_2Q_1
S_0	0 0
S_1	0 1
S_2	1 0
S_3	1 1

故没有无关项

真值表：

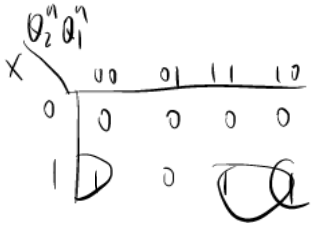
输入	现态	次态	触发器	输出
X	$Q_2^nQ_1^n$	$Q_2^{n+1}Q_1^{n+1}$	D_2D_1	Z
0	0 0	0 0	0 0	0
0	0 1	0 0	0 0	0
0	1 0	0 0	0 0	0
0	1 1	0 0	0 0	0
1	0 0	0 1	0 1	0
1	0 1	1 0	1 0	0
1	1 0	1 1	1 1	0
1	1 1	1 1	1 1	1

卡诺图



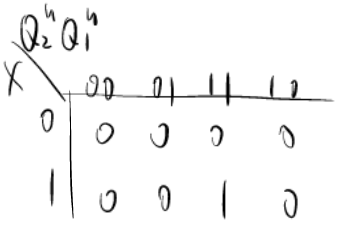
$D_2 = XQ_1^n + XQ_2^n$

$= X(Q_1^n + Q_2^n)$



$D_1 = XQ_2^n + X\overline{Q_1^n}$

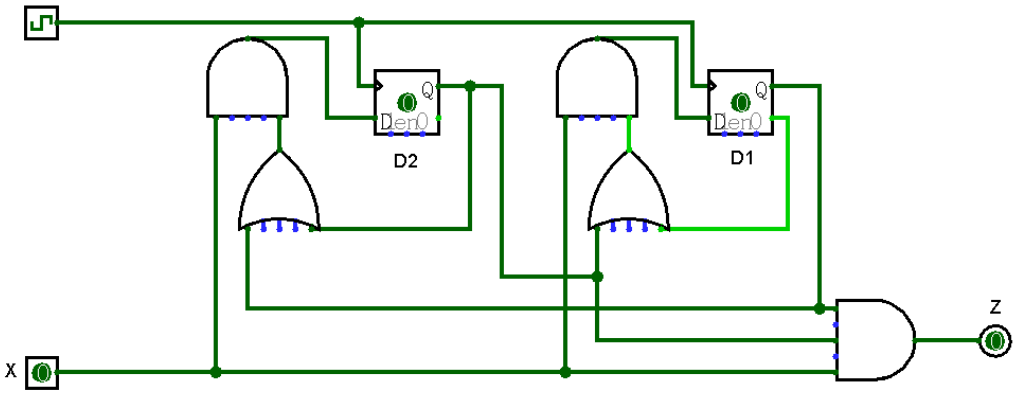
$= X(Q_2^n + \overline{Q_1^n})$



$Z = XQ_2^nQ_1^n$

无关项检测：由于状态总数为4，对应到2个D触发器，没有无关项

logisim 电路如下所示：


Q
Der0
D2
Q
Der0
D1
Z
X