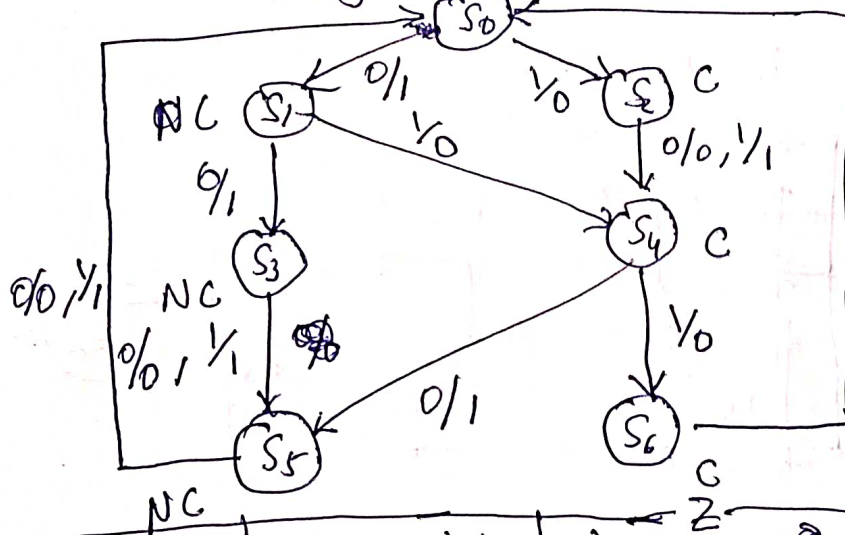


# BCD to Excess 3 coded decimal

X Input BCD				Z output (excess-3)			
$t_3$	$t_2$	$t_1$	$t_0$	$t_3$	$t_2$	$t_1$	$t_0$
0	0	0	0	0	0	1	1
0	0	0	1	0	1	0	0
0	0	1	0	0	1	0	1
0	0	1	1	0	1	1	0
0	1	0	0	0	1	1	1
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0

BCD + 0011 → Excess 3

Mealy state Graph



NC - No carry  
C - Carry

Present state	Next state		$X=0$	$X=1$
$S_0$	$S_1$	$S_2$	1	0
$S_1$	$S_3$	$S_4$	1	0
$S_2$	$S_4$	$S_5$	0	1
$S_3$	$S_5$	$S_6$	1	0
$S_4$	$S_6$	$S_0$	0	1
$S_5$	$S_0$	$S_1$	1	0
$S_6$	$S_1$	$S_2$	0	1

2. States that have the same NS

I. (1,2), (3,4), (5,6) [In the  $X=1$  column,  $S_1$  &  $S_2$  both have NS  $S_4$  in the  $X=0$  column,  $S_3$  and  $S_4$  have NS  $S_5$  &  $S_5$  and  $S_6$  have NS  $S_6$ ]

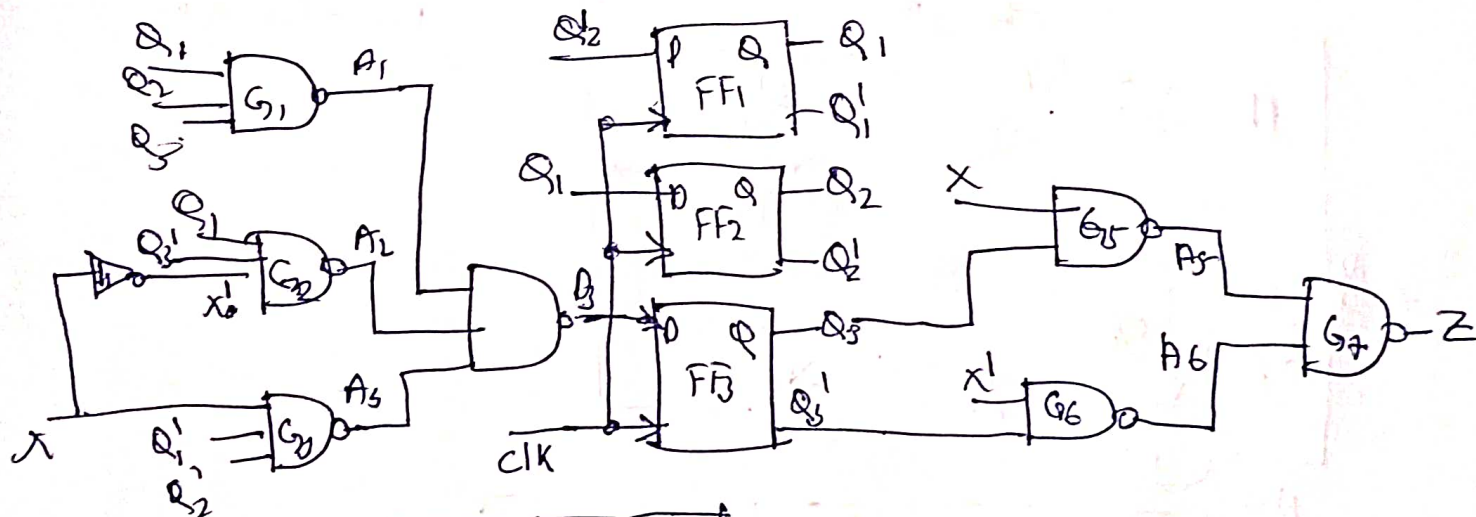
II. (1,2), (3,4), (5,6) [ $S_1$  and  $S_2$  are NS of  $S_0$  &  $S_3$  and  $S_4$  & NS of  $S_5$  &  $S_5$  and  $S_6$  are NS of  $S_4$ ]

III. (0,1,4,6), (2,3,5)

$Q_2 Q_3$	$Q_1=0$	$Q_1=1$
00	$S_0$	$S_1$
01		$S_2$
11	$S_5$	$S_3$
10	$S_4$	$S_4$

$Q_1 Q_2 Q_3$	$Q_1^+ Q_2^+ Q_3^+$ $X=0$	$Q_1^+ Q_2^+ Q_3^+$ $X=1$	$X=0$	$X=1$
000	100	101	1	0
001	111	110	1	0
101	110	110	0	1
111	011	011	0	1
110	011	010	1	0
011	000	000	0	1
010	000	XXX	1	X
001	XXX	XXX	X	X

Transition table



$Q$	$Q'$	$J$	$K$
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0