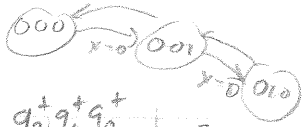


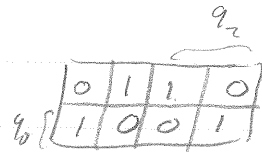
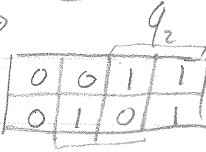
Binary Counter



$q_2 q_1 q_0$	$x=0$	$x=1$	z
000	001	111	000
001	010	000	
010	011	001	
011	100	010	
100	101	011	
101	110	100	
110	111	101	
111	000	110	

Count up only

DFF



$$q_2^+ = q_2 \bar{q}_0 + q_2 \bar{q}_1 + \bar{q}_2 q_1 q_0$$

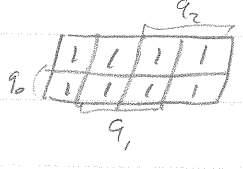
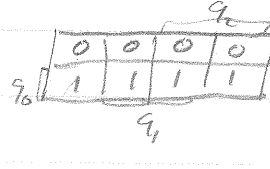
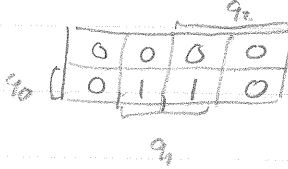
$$q_1^+ = q_1 \bar{q}_0 + \bar{q}_1 q_0$$

$$q_0^+ = \bar{q}_0$$

↑
x=0
count up

↑
x=1
count down

T-FF



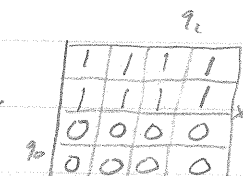
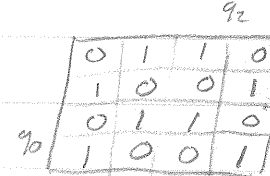
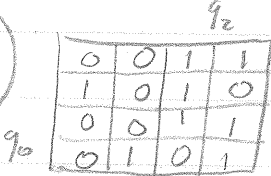
$$T_2 = q_1 q_0$$

$$T_1 = q_0$$

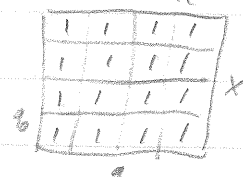
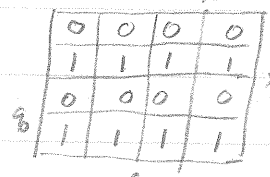
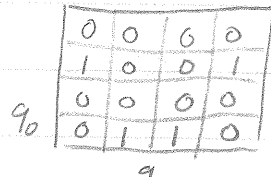
$$T_0 = 1$$

count up/down

next state (D-FF) →



T-FF →



$$T_2 = \bar{x} q_1 q_0 + x \bar{q}_1 \bar{q}_0$$

$$T_1 = \bar{x} q_0 + x \bar{q}_0$$

$$T_0 = 1$$