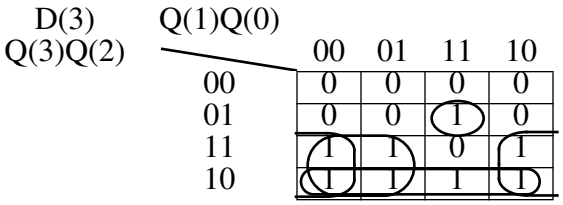
A. 4-bit up-counter transition table

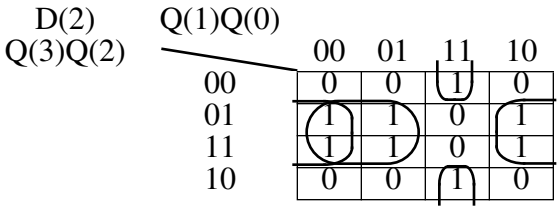
Present State				Next State			
$Q_i(3)$	$Q_i(2)$	$Q_i(1)$	$Q_i(0)$	$Q_{i+1}(3)$	$Q_{i+1}(2)$	$Q_{i+1}(1)$	$Q_{i+1}(0)$
0	0	0	0	0	0	0	1
0	0	0	1	0	0	1	0
0	0	1	0	0	0	1	1
0	0	1	1	0	1	0	0
0	1	0	0	0	1	0	1
0	1	0	1	0	1	1	0
0	1	1	0	0	1	1	1
0	1	1	1	1	0	0	0
1	0	0	0	1	0	0	1
1	0	0	1	1	0	1	0
1	0	1	0	1	0	1	1
1	0	1	1	1	1	0	0
1	1	0	0	1	1	0	1
1	1	0	1	1	1	1	0
1	1	1	0	1	1	1	1
1	1	1	1	0	0	0	0

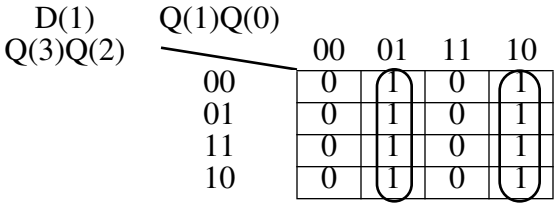
B. 4-bit up-counter D-FF truth table

Inputs				Outputs			
Q(3)	Q(2)	Q(1)	Q(0)	D(3)	D(2)	D(1)	D(0)
0	0	0	0	0	0	0	1
0	0	0	1	0	0	1	0
0	0	1	0	0	0	1	1
0	0	1	1	0	1	0	0
0	1	0	0	0	1	0	1
0	1	0	1	0	1	1	0
0	1	1	0	0	1	1	1
0	1	1	1	1	0	0	0
1	0	0	0	1	0	0	1
1	0	0	1	1	0	1	0
1	0	1	0	1	0	1	1
1	0	1	1	1	1	0	0
1	1	0	0	1	1	0	1
1	1	0	1	1	1	1	0
1	1	1	0	1	1	1	1
1	1	1	1	0	0	0	0

C. Karnaugh Maps for D(3), D(2), D(1).







$D(3) = \overline{Q(3)}\ Q(2)\ Q(1)\ Q(0) + Q(3)\ \overline{Q(2)} + Q(3)\ \overline{Q(1)} + Q(3)\ \overline{Q(0)}$

$D(2) = \overline{Q(2)}\ Q(1)\ Q(0) + Q(2)\ \overline{Q(1)} + Q(2)\ \overline{Q(0)}$

$D(1) = \overline{Q(1)}\ Q(0) + Q(1)\ \overline{Q(0)}$