

Shift register with feedback (DGTL_counter_2.sqproj)

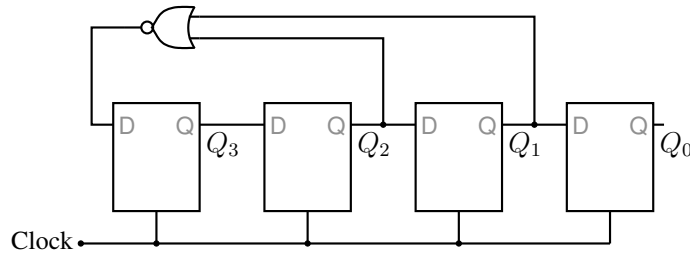


Figure 1: Shift register with feedback.

Question: In the circuit shown in Fig. 1, the initial state is $Q_3Q_2Q_1Q_0 = 1000$. Find the next six states.

Solution:

The circuit is a shift register, with a logical function $(\overline{Q_1 + Q_2})$ being fed back as D_3 . We look at the input of each flip-flop D_i just before the active clock edge, and use it to set its output Q_i just after the active clock edge, i.e., $Q_i(t_k^+) = D_i(t_k^-)$. Using this procedure, we obtain the state table given below. The corresponding waveforms are shown in Fig. 2.

k	t_k^-					D_3	t_k^+			
	Q_3	Q_2	Q_1	Q_0	Q_3		Q_2	Q_1	Q_0	
1	1	0	0	0	1	1	1	0	0	
2	1	1	0	0	0	0	1	1	0	
3	0	1	1	0	0	0	0	1	1	
4	0	0	1	1	0	0	0	0	1	
5	0	0	0	1	1	1	0	0	0	
6	1	0	0	0	1	1	1	0	0	

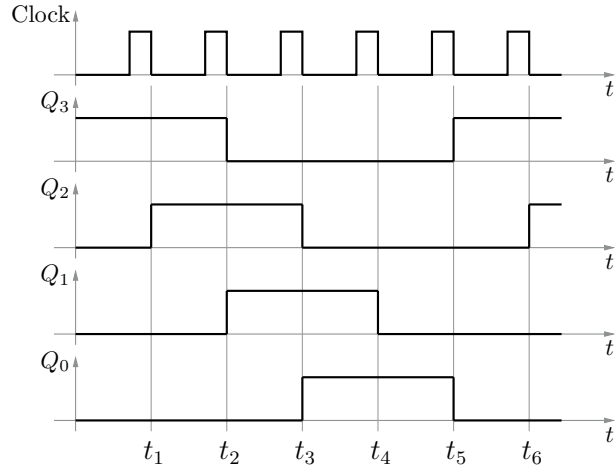


Figure 2: Waveforms for the circuit of Fig. 1.

SequelApp Exercises: In the circuit shown in Fig. 3, the initial state is $Q_3Q_2Q_1Q_0 = 0100$. Find the next six states.

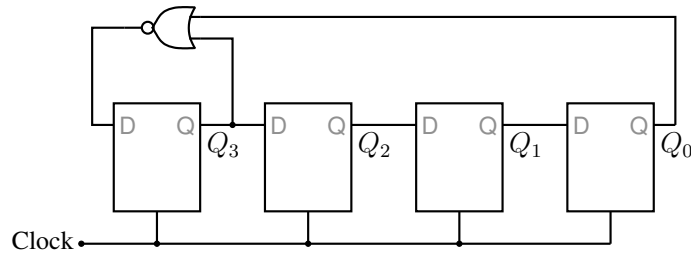


Figure 3: Shift register with feedback.

Verify your answers using SequelApp.