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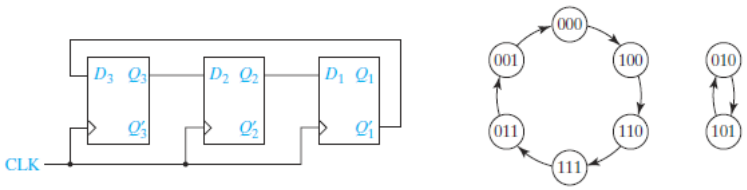
Homework Unit 12

1. Construct a 4-bit Johnson counter using J-K flip-flops. What sequence of states does the counter go through if it is started in state 0000? State 0110?

   (Hint: refer a 3-bit Johnson counter shown below)

FIGURE 12-12
Shift Register with Inverted Feedback



(a) Flip-flop connections (b) Transition graph

2. Design a 3-bit counter using D flip-flops which counts in the sequence: 001, 100, 101, 111, 110, 010, 011, (repeat) 001, … What will happen if the counter of is started in state 000?

3. A sequential circuit contains a register of four flip-flops. Initially a binary number N (0000 ≤ N ≤ 1100) is stored in the flip-flops. After a single clock pulse is applied to the circuit, the register should contain N + 0011. In other words, the function of the sequential circuit is to add 3 to the contents of a 4-bit register. Design the circuit using J-K flip-flops.

4. An L-M flip-flop works as follows:

   If LM = 00, the next state of the flip-flop is 1.

   If LM = 01, the next state of the flip-flop is the same as the present state.

   If LM = 10, the next state of the flip-flop is the complement of the present state.

   If LM = 11, the next state of the flip-flop is 0.

   (a) Complete the following table (use don't-cares when possible).

Present State Q	Next State Q^+	L	M
0	0		
0	1		
1	0		
1	1		

   (b) Using this table and Karnaugh maps, derive and minimize the input equations for a counter

composed of three L-M flip-flops which counts in the following sequence: ABC = 000, 100, 101, 111, 011, 001, (repeat) 000, ...