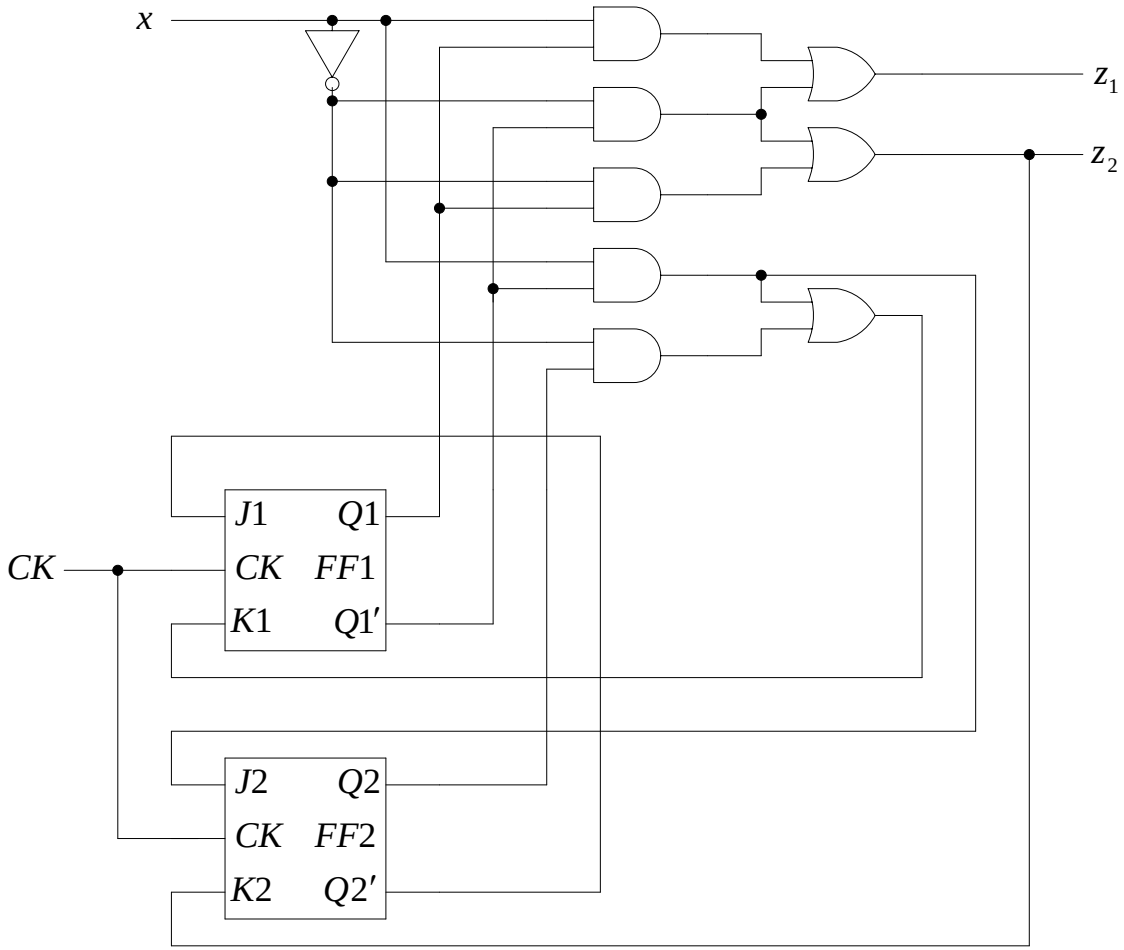
Analysis (Contd.)

Analyze this sequential circuit:



Step 1. The excitation equations of the flip-flops are written from the combinational circuit as:

$$J1_n = Q2'_n$$
$$K1_n = xQ1'_n + x'Q2_n$$
$$J2_n = xQ1'_n$$
$$K2_n = x'Q1'_n + x'Q1_n = x'$$

The output equations are written from the combinational logic circuits as:

$$z_1 = xQ1_n + x'Q1'_n$$
$$z_2 = x'Q1'_n + x'Q1_n = x'$$

Step 2. The next state equations of the J-K flip-flops are written from the excitation equations in conjunction with characteristic equation of J-K flip-flops as:

$$\begin{aligned} Q1_{n+1} &= J1_n Q1'_n + K1'_n Q1_n \\ &= Q2'_n Q1'_n + (xQ1'_n + x'Q2_n)'Q1_n \\ &= Q1'_n Q2'_n + (x' + Q1_n)(x + Q2'_n)Q1_n \\ &= Q1'_n Q2'_n + x'Q1_n Q2'_n + xQ1_n + Q1_n Q2'_n \\ &= Q1'_n Q2'_n + Q1_n Q2'_n(x' + 1) + xQ1_n \\ &= Q2'_n(Q1'_n + Q1_n) + xQ1_n \\ &= Q2'_n + xQ1_n \end{aligned}$$

$$\begin{aligned} Q2_{n+1} &= J2_n Q2'_n + K2'_n Q2_n \\ &= xQ1'_n Q2'_n + xQ2_n \end{aligned}$$

Step 3. The transition table for the circuit is prepared from the next state equations and output equations and shown in Table 10.3.

Table 10.3 Transition table for the sequential circuit of Figure 10.4.

Present state $Q1_n Q2_n$	Next state $Q1_{n+1} Q2_{n+1}$ Input x		Outputs $z_1 z_2$ Input x	
	0	1	0	1
00	10	11	11	00
01	00	01	11	00
11	00	11	01	10
10	10	10	01	10

Analysis (Contd.)

Step 4. The transition diagram for the circuit is prepared from the transition table of Table 10.3 and is shown in Figure 10.5.

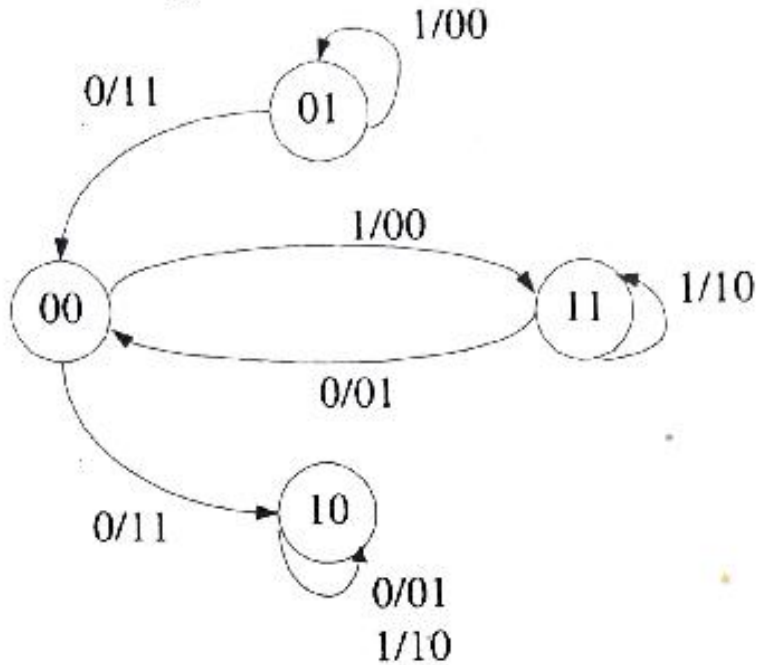


Figure 10.5 Transition diagram for the sequential circuit of Figure 10.4.