**Exercise 1**. Find the minimum-cost SOP and POS form for the function:

$$f(x_1, x_2, x_3) = \sum m(1, 4, 7) + D(2, 5)$$

**Exercise 2**. Repeat exercise 1 for the function:

$$f(x_1, x_2, x_3, x_4) = \prod M(0, 1, 2, 4, 5, 7, 8, 9, 10, 12, 14, 15)$$

**Exercise 3**. A four-variable logic function that is equal to 1 if any three or all four of its variables are equal to 1 is called *majority* function. Design a minimum-cost SOP circuit that implements this *majority* function.

**Exercise 4**. Prove or show a counter-example for the statement: "if a function f has a unique minimum-cost SOP expression, then it also has a unique minimum-cost POS expression"

**Exercise 5**. Figure 1 shows a BCD-counter that produces a four-bit output representing the BCD code for the number of pulse that have been applied to the counter input. For example, after four pulses have occurred, the counter outputs are DCBA = 01002 = 410. The counter resets to 0000 for a tenth pulse and start counting over again. Design the logic circuit that produce a HIGH output when ever the count is 2, 3, or 9. Using the K-map and take advantages of the don't-care conditions

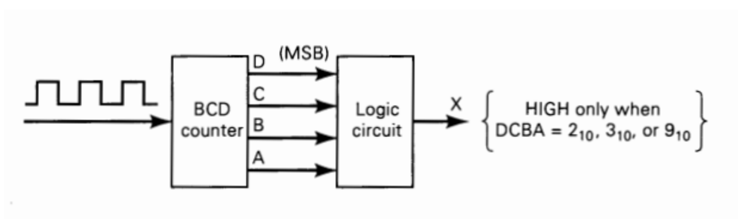


**Figure 1. Circuit for exercise 5**

**Exercise 6**. The circuit in figure 2 looks like a counter. What is the sequence that this circuits counts in?

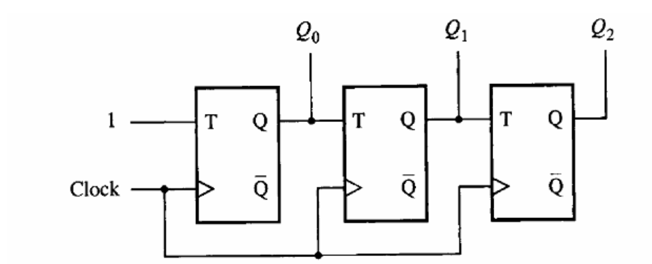


**Figure 2. Circuit for exercise 5.**

**Exercise 7**. Determine the functional behavior of the circuit in figure 3. Assume that input w is driven by a square signal.

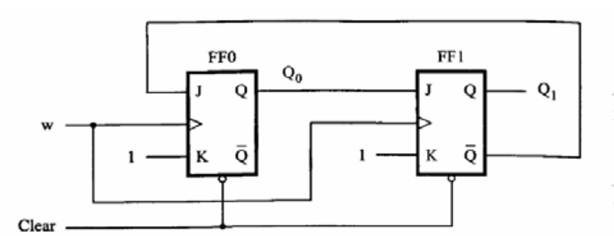


**Figure 3. Circuit for exercise 6.**