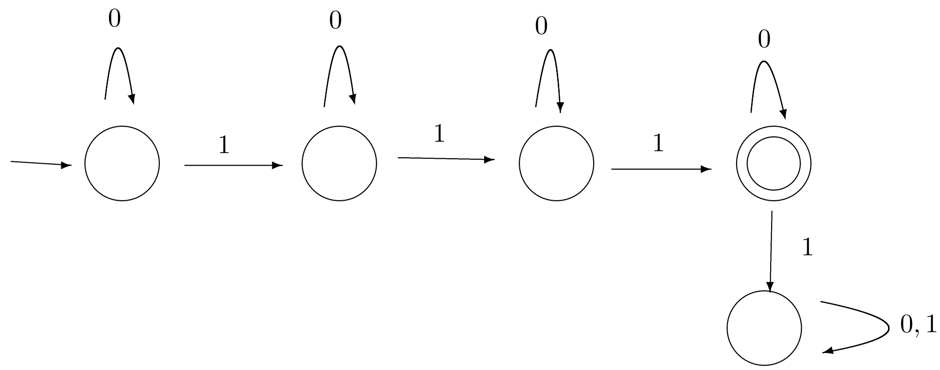
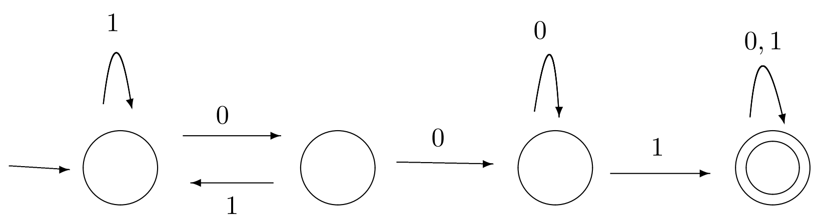
CS 420, Fall 2019
Homework 1 Solutions

1. Give DFAs that recognize the following languages

   (a) $\{w \in \{0,1\}^* | w \text{ contains exactly three 1's}\}$.
   Solution:

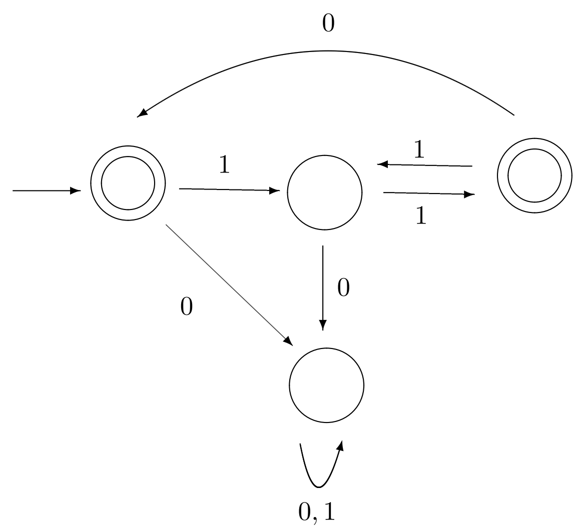


   (b) $\{w \in \{0,1\}^* | w \text{ contains 001 as a substring}\}$.
   Solution:



(c) $\{11, 110\}^*$.

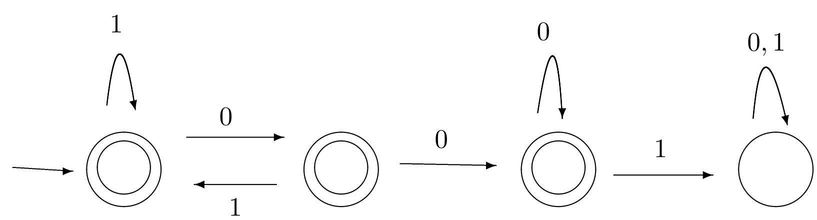
Solution:



2. Using the complementation construction and one of the DFAs from Exercise 1, give a DFA that recognizes the language

$$\{w \in \{0,1\}^* | w \text{ does not contain } 001 \text{ as a substring}\}.$$

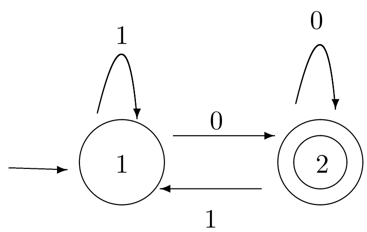
Solution:



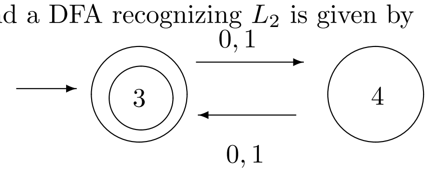
3. Let $L = \{w \in \{0,1\}^* | w \text{ ends with a } 0 \text{ or has even length}\}$. Starting with DFAs for two simpler languages, use the union construction to give a DFA that recognizes L.

Solution:

Let $L_1 = \{w \in \{0,1\}^* | w \text{ ends with a } 0\}$ and $L_2 = \{w \in \{0,1\}^* | w \text{ has even length}\}$. Then, $L = L_1 \cup L_2$. A DFA recognizing L_1 is given by



and a DFA recognizing L_2 is given by



The union construction gives the following DFA that recognizes $L_1 \cup L_2 = L$.