

CSE 311: Foundations of Computing I

Section : CFGs & FSMs Solutions

0. CFGs

Construct CFGs for the following languages:

- (a) All binary strings that end in 00.

Solution:

$$S \rightarrow 0S \mid 1S \mid 00$$

- (b) All binary strings that contain at least three 1's.

Solution:

$$\begin{aligned} S &\rightarrow 0S \mid 1T_1 \\ T_1 &\rightarrow 0T_1 \mid 1T_2 \\ T_2 &\rightarrow 0T_2 \mid 1T_3 \\ T_3 &\rightarrow 0T_3 \mid 1T_3 \mid \varepsilon \end{aligned}$$

- (c) All binary strings with an equal number of 1's and 0's.

Solution:

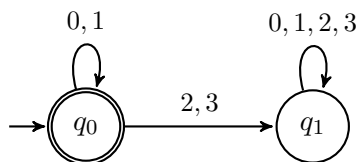
$$\begin{aligned} S &\rightarrow 0S1S \mid 1S0S \mid \varepsilon \\ S &\rightarrow SS \mid 0S1 \mid 1S0 \mid \varepsilon \end{aligned}$$

1. DFAs, Stage 1

Construct DFAs to recognize each of the following languages. Let $\Sigma = \{0, 1, 2, 3\}$.

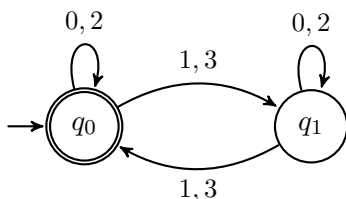
(a) All binary strings.

Solution:



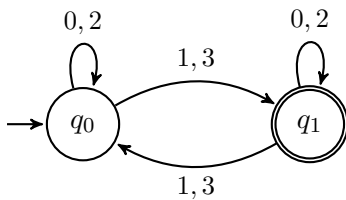
(b) All strings whose digits sum to an even number.

Solution:



(c) All strings whose digits sum to an odd number.

Solution:

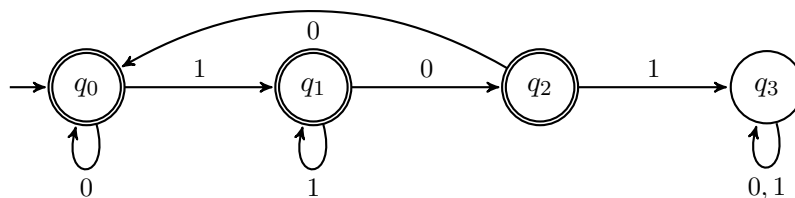


2. DFAs, Stage 2

Construct DFAs to recognize each of the following languages. Let $\Sigma = \{0, 1\}$.

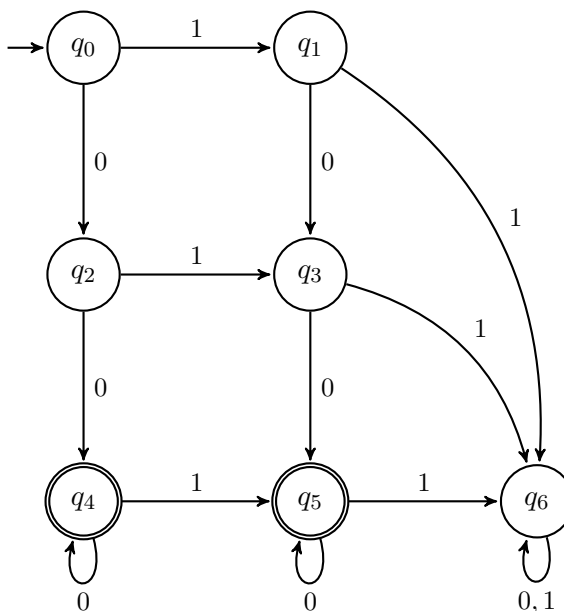
(a) All strings which do not contain the substring 101.

Solution:



(b) All strings containing at least two 0's and at most one 1.

Solution:



(c) All strings containing an even number of 1's and an odd number of 0's and not containing the substring 10.

Solution:

