CS 3530: Assignment 1b

Fall 2023

Cutler Thomas

Note: In each of the following, you should show and describe the simpler DFAs as well as the final DFA or NFA that you construct. You must follow the steps of each construction precisely. Do not take shortcuts or simplify the results. You do not need to show intermediate steps.

If a DFA is called for, an NFA is not acceptable. Be sure to include *all* states and transitions of a DFA.

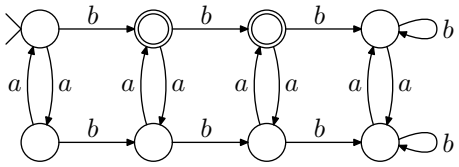
Exercise 1.4c (4 points)

Problem

Each of the following languages is the intersection of two simpler languages. In each part, construct DFAs for the simpler languages, then combine them using the construction discussed in footnote 3 (page 46) to give the state diagram of a DFA for the language given. In all parts $\Sigma = \{a, b\}$.

c. Language: $\{w | w$ has an even number of a's and one or two b's$\}$

Solution



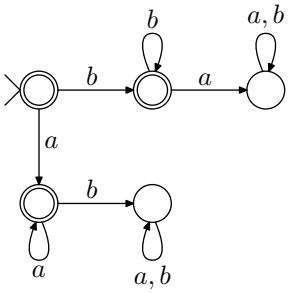
Exercise 1.5c (4 points)

Problem

Each of the following languages is the complement of a simpler language. In each part, construct a DFA for the simpler language, then use it to give the state diagram of a DFA for the language given. In all parts $\Sigma = \{a, b\}$.

c. Language: $\{w | w$ contains neither the substrings ab nor $ba\}$

Solution



Exercise 1.8b (3 points)

Problem

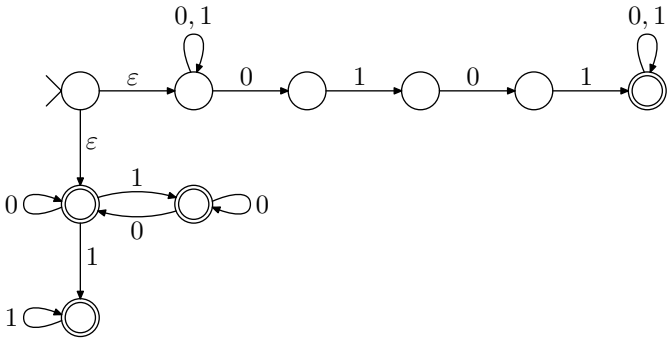
Use the construction given in the proof of Theorem 1.45 to give the state diagrams of NFAs recognizing the union of the languages given.

b. Language: $L_1 \cup L_2$ where L_1 is the language from 1.6c and L_2 is the language from 1.6f
(note: both languages are from assignment 1a)

Language from 1.6c: $\{w|w$ contains the substring 0101, i.e., $w = x0101y$ for some x and $y\}$

Language from 1.6f: $\{w|w$ doesn't contain the substring 110$\}$

Solution



Exercise 1.9b (3 points)

Problem

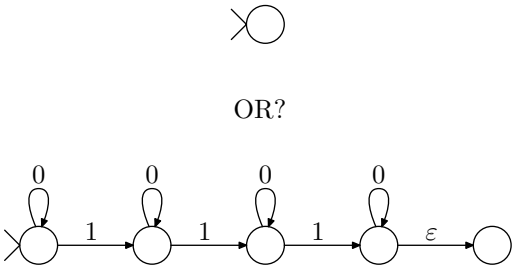
Use the construction given in the proof of Theorem 1.47 to give the state diagrams of NFAs recognizing the concatenation of the languages given.

b. Language: $L_1 \circ L_2$ where L_1 is the language from 1.6b and L_2 is the language from 1.6m
(note: both languages are from assignment 1a)

Language from 1.6b: $\{w|w$ contains at least three 1s$\}$

Language from 1.6m: The empty set

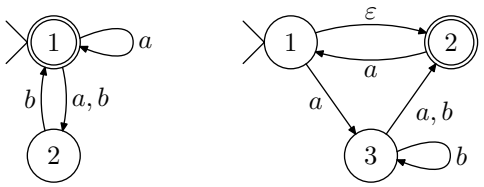
Solution



Exercise 1.16 (6 points)

Problem

Use the construction given in Theorem 1.39 to convert the following two nondeterministic finite automata to equivalent deterministic finite automata.



Solution