CS 3530: Assignment 2a

Fall 2014

Name: Eric Beilmann

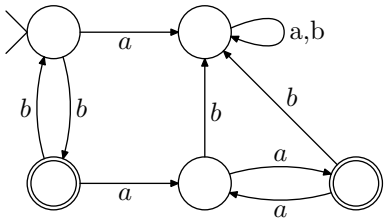
Exercises

Exercise 1.12 (6 points)

Problem

Let $D = \{w : w$ contains an even number of a's and an odd number of b's and does not contain the substring $ab\}$. Give a DFA with five states that recognizes D and a regular expression that generates D. (Suggestion: Describe D more simply).

DFA Solution



RE = b((bb)*(aa)*)

Exercise 1.18 (14 points)

Problem

Give regular expressions generating the languages of Exercise 1.6.

a. $\{w : w$ begins with a 1 and ends with a 0$\}$

Solution

RE = 1Σ*0

b. $\{w : w$ contains at least three 1s$\}$

Solution

RE = Σ*1Σ*1Σ*1Σ*

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

Solution

RE = Σ*0101Σ*

d. $\{w : w$ has length at least 3 and its third symbol is a 0$\}$

Solution

RE = ΣΣ0Σ*

e. $\{w : w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$

Solution

RE = $0((0\cup1)(0\cup1))^* \cup 1(0\cup1)((0\cup1)(0\cup1))^*$

f. $\{w : w$ doesn't contain the substring 110$\}$

Solution

RE = $(0\cup10)^*1^*$

g. $\{w :$ the length of w is at most 5$\}$

Solution

RE = $(0\cup1)\cup((0\cup1)(0\cup1))\cup((0\cup1)(0\cup1)(0\cup1)) \cup((0\cup1)(0\cup1)(0\cup1)(0\cup1))\cup((0\cup1)(0\cup1)(0\cup1)(0\cup1)(0\cup1))$

h. $\{w : w$ is any string except 11 and 111$\}$

Solution

RE = $(0\cup1) \cup (00\cup01\cup10) \cup (0\Sigma\Sigma \cup \Sigma0\Sigma \cup \Sigma\Sigma0)(\Sigma)^*$

i. $\{w :$ every odd position of w is a 1$\}$

Solution

RE = $(1((01)\cup(11))^*) \cup (1((01)\cup(11))^*\cup(0\cup1))$

j. $\{w : w$ contains at least two 0s and at most one 1$\}$

Solution

RE = $(0)^*(001 \cup 010 \cup 100)(0)^*$

k. $\{\varepsilon, 0\}$

Solution

RE = $(0)^*$

l. $\{w : w$ contains an even number of 0s, or contains exactly two 1s$\}$

Solution

RE = $((00)^* \cup (1)^*)^*\ (00)\ ((00)^* \cup (1)^*) \cup ((0)^*1(0)^*1(0)^*)$

m. The empty set

Solution

RE = $1^*\emptyset$

n. All strings except the empty string

Solution

RE = $(0\cup1)(0\cup1)^*$