CS 3530: Assignment 1d

Fall 2023

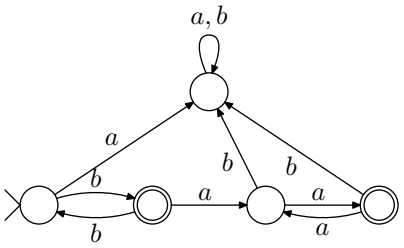
Your Name Here

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).

Solution



$D = b(bb) * (aa)*$

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 $1(0 + 1) * 0$

b. $\{w|w$ contains at least three 1s$\}$
Solution $(0 + 1) * 1(0 + 1) * 1(0 + 1) * 1(0 + 1)*$

c. $\{w|w$ contains the substring 0101, i.e., $w = x0101y$ for some x and $y\}$
Solution $(0 + 1) * 0101(0 + 1)*$

d. $\{w|w$ has length at least 3 and its third symbol is a $0\}$
Solution $(0 + 1)(0 + 1)0(0 + 1)*$

e. $\{w|w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$
Solution $0((0 + 1)(0 + 1)) * +1(0 + 1)((0 + 1)(0 + 1))*$

f. $\{w|w$ doesn't contain the substring 110$\}$
Solution $0 * (10^{+}) * 1*$

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

Solution $\varepsilon + (0+1) + (0+1)^2 + (0+1)^3 + (0+1)^4 + (0+1)^5$

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

Solution $\varepsilon + (0+1) + 0(0+1) + 10 + 0(0+1)(0+1) + 10(0+1) + 110 + (0+1)^3(0+1)^+$

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

Solution $(1(0+1)) * (\varepsilon + 1)$

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

Solution $00 * 00 * (\varepsilon + 1) + 00 * (\varepsilon + 1)00 * +(\varepsilon + 1)00 * 00*$

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

Solution $0 + \varepsilon$

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

Solution $1 * (01 * 01*) * +0 * 10 * 10*$

m. The empty set

Solution $null$

n. All strings except the empty string

Solution $(0+1)^+$