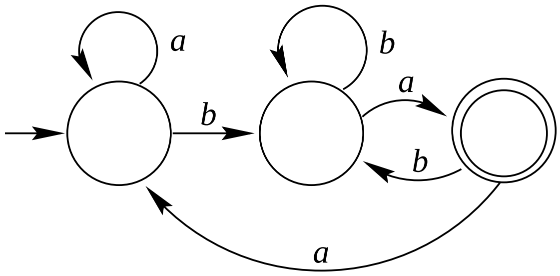
Exercises about finite automata and corresponding regular expressions

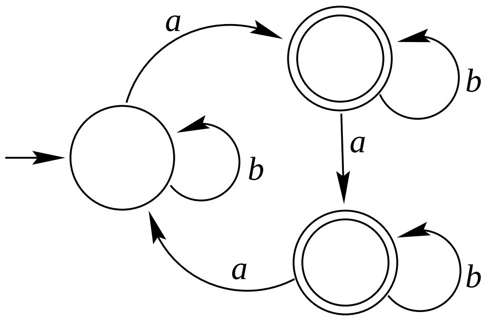
1. Remove all ϵ-transitions from the Goblins' Gingerbread automaton and transform it to deterministic!

2. What kind of language does the Goblins' Gingerbread automaton recognize? Describe the language as a regular expression!

3. Give the regular expressions corresponding the following automata!



(a)



(b)

4. Construct the finite automata corresponding the following regular expressions!
a)$(ab)^*(ba)^* \bigcup aa^*$
b)$((ab \bigcup abb)^* a^*)^*)$

5. For what practical applications could you use finite automata or regular expressions? Give at least three applications!

6. Let w^R = reversal of string w (i.e. if $w = a_1 a_2 ... a_n$, then $w^R = a_n ... a_2 a_1$). Prove that if the language L in alphabet $\{a, b\}$ is regular, then also its reversal language

$$L^R = \{w^R | w \in L\}$$

is regular. (Hint: concider automata.)

7. Prove that the class of regular languages is closed under cut and concatenation. I.e. if L_1 and L_2 are regular languages, then also $L_1 \bigcap L_2$ and $L_1 L_2$ are regular. (Hint: automata and de Morgan law: $A \bigcap B = \overline{\overline{A} \bigcup \overline{B}}$.)

8. Install the JFLAP 4.0 automaton tool. `http://www.cs.duke.edu/ rodger/tools/tools.html`) Use the program to find out, if the following expressions are equivalent:

   $a^* b^* \bigcup (a \bigcup b)^* ba (a \bigcup b)^*$, $(a^* b^*)^*$ ja $(a \bigcup b \bigcup ab \bigcup ba)^*$!