

Tutorial 1

Notation: For $w \in \Sigma^*$ let w^R be the reverse of the string w , i.e. if $|w| = 1$ then $w^R = w$ and for $|w| > 1$ and $w = u \cdot a$ then $w^R = a \cdot u^R$.

1. Give a DFA over the alphabet $\{0, 1\}^*$ such that it accepts strings which are the binary representations of a number which is $3 \pmod{5}$.
2. Give a DFA over the alphabet $\{0, 1\}^*$ such that it accepts strings which are the binary representations of a number which is not $3 \pmod{5}$. i.e. it accepts a string if it is the binary representation of a number which is $0 \pmod{5}$, $1 \pmod{5}$, $2 \pmod{5}$, or $4 \pmod{5}$.
3. Give a DFA over the alphabet $\{a, b\}^*$ that accepts strings which do not contain aaa as a substring.
4. Give a DFA over the alphabet $\{a, b\}^*$ that accepts all strings which contain aab as a substring but do not contain aaa as a substring.
5. Give a DFA which accepts the following language.
 $L = \{w \in \{a, b\}^* \mid w \text{ contains at least two a's and at most one b}\}.$
6. Give a DFA which accepts the following language.
 $\{w \in \{a, b\}^* \mid w \text{ either starts with the letter a or ends with the letter b}\}.$
7. Let L be the language in Question 5 above. What is the language $L \circ L$?
8. Is there any gadget/object that you use in your day-to-day life which can be modelled as a DFA? Write down the DFA for it.