

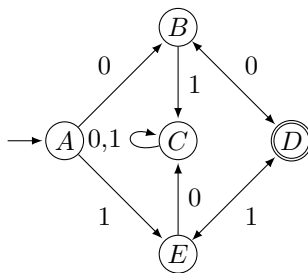
Finite automata

Let $\Sigma = \{0,1\}$ for all exercises if it is not stated otherwise.

1. Give a FA recognizing the language

$$L = \{w \mid \text{the number of 1s in } w \text{ is divisible by 2 and the number of 0s is divisible by 3}\}.$$

2. Give a FA recognizing the language of numbers. Here the alphabet consists of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and the decimal point. The language contains the integers (like 123). A number cannot start with 0 except if its integer part is 0 (so 012 is not allowed but 0 or 0.12 is correct). Every number needs at least one digit but if there is a decimal point then a number can contain only integer or fractional part (so the strings 123.456 and 123. and .456 belong to the language).
3. Determine the language accepted by the finite automaton



4. Let $s_1 = 001$, $s_2 = 100$, $s_3 = 1111$. Prove that the following languages are regular:
 - (a) The language L_1 of all strings containing s_1 as a substring.
 - (b) The language L_2 of all string containing both s_1 and s_2 as substrings (they can overlap, so 00100 is in the language).
 - (c) The language L_3 of all string containing exactly two of the strings s_1 , s_2 , s_3 as substrings.
5. * Consider the strings as integer numbers written in binary. Give a FA that accepts those numbers that are divisible by 3. (Ex. 1100 is in the language but 101 is not.)