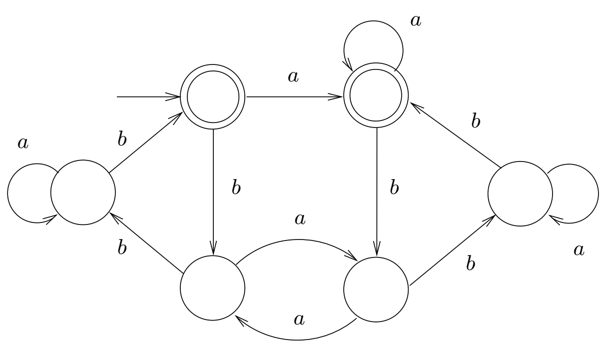
Instructions

- Classroom Problems C3.1–C3.2 will be discussed and solved onsite at the tutorial sessions in lecture week 3. No credit is given for these problems.
- Homework Problems H3.1–H3.3 you should solve on your own, and be available to present your solutions at one of the tutorial sessions in lecture week 4. In order to get course credit, you need to indicate your solved problems on the signup sheet circulated at the beginning of the session.
- Supplementary Problems S3.1–S3.2 provide further illustration and extension of the course material, but will usually not be covered at the tutorials. You are however invited to work on these problems too, and discuss them with the course staff. Sample solutions are provided on MyCourses.

Classroom Problems

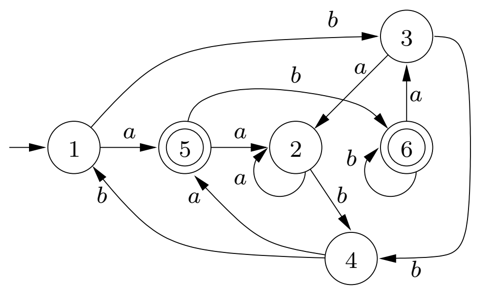
C3.1 Construct the minimal automaton corresponding to the following deterministic finite automaton:



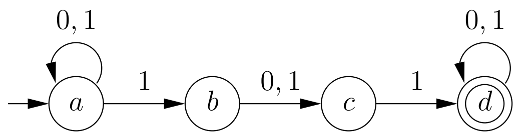
C3.2 Design a nondeterministic ε-automaton that tests whether a given binary input sequence ends with the subsequence 101 or 110. Remove the ε-transitions from your automaton and make it deterministic.

Homework Problems

H3.1 Construct the minimal automaton corresponding to the following deterministic finite automaton:



H3.2 Consider the following nondeterministic finite automaton M recognising a language $\mathcal{L}(M)$ over the alphabet $\{0, 1\}$:



Construct the *minimal deterministic* finite automaton that recognises the *complement* of the language $\mathcal{L}(M)$.

H3.3 Show that if a language $L \subseteq \{a, b\}^*$ is recognised by some finite automaton, then there are also finite automata that recognise the following languages, consisting of all the prefixes and suffixes of the words in L:

(i) $\mathrm{Pref}(L) = \{x \in \{a, b\}^* \mid xy \in L \text{ for some } y \in \{a, b\}^*\}$,

(ii) $\mathrm{Suff}(L) = \{y \in \{a, b\}^* \mid xy \in L \text{ for some } x \in \{a, b\}^*\}$.

Supplementary Problems

S3.1 Design a nondeterministic finite automaton that tests whether in a given binary input sequence the third-to-last bit is a 1. Make the automaton deterministic using the subset construction.

S3.2 Show that if a language $L \subseteq \{a, b\}^*$ is recognised by some finite automaton, then so is the language $L^R = \{w^R \mid w \in L\}$. (The notation w^R means the reverse of string w, that is, the string where the symbols of w are in reverse order.)