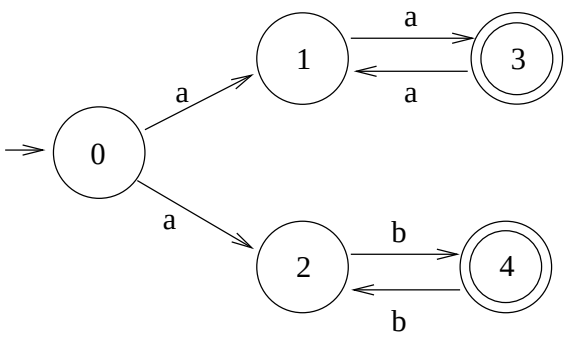
Exercise session 4

1. Tranform the following automaton to deterministic!



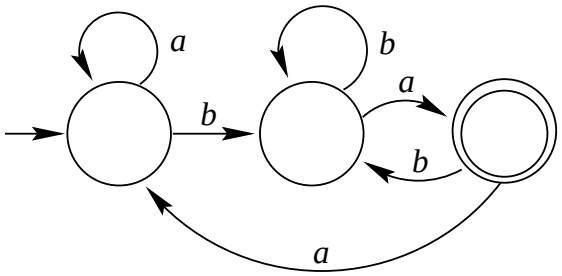
2. Give nondeterministic finite automata to accept the following languages. Try to take advantage of nondeterminism as much as possible.

   a) The set of strings over alphabet $\{0, 1, ..., 9\}$ such that the final digit has appeared before.
   b) The set of strings over alphabet $\{0, 1, ..., 9\}$ such that the final digit has *not* appeared before.
   c) The set of strings over alphabet $\{0, 1\}$ such that there are two 0's separated by a number of 1's that is a multiple of 4. Note that 0 is an allowable multiple of 4.

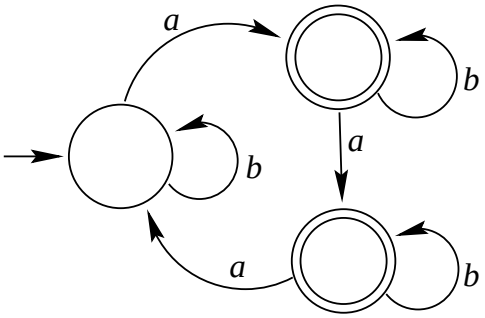
3. Remove all ϵ-transitions from the Goblins' Gingerbread automaton and transform it to deterministic!
   (See `http://cs.joensuu.fi/pages/whamalai/tepe04/redhood.pdf`)

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

5. Give the regular expressions corresponding the following automata!



(a)



(b)

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

7. Let M_1 and M_2 be automata, which recognize languages $L_1 = (ab)(ab)^*$ and $L_2 = (ba)(ba)^*$. Construct an ϵ-automaton, which recognizes language $(L_1 \cup L_2)^*$. Remove ϵ-transitions from the automaton!