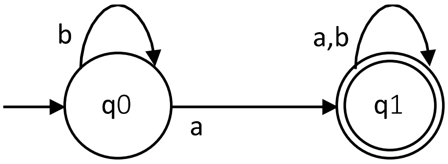
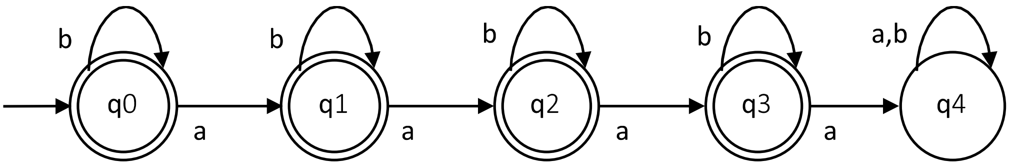
MET CS662 - Assignment #3
Machida Hiroaki

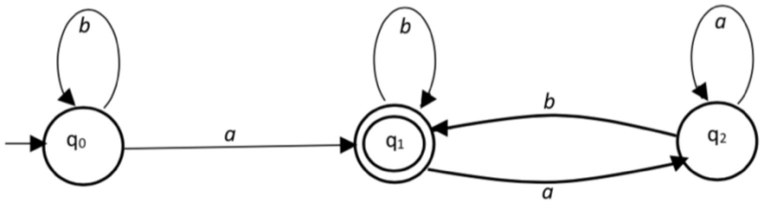
1. For $\Sigma = \{a, b\}$, construct deterministic finite automata that accept the sets consisting of
a) All strings with at least one a.



b) All strings with no more than three a's.



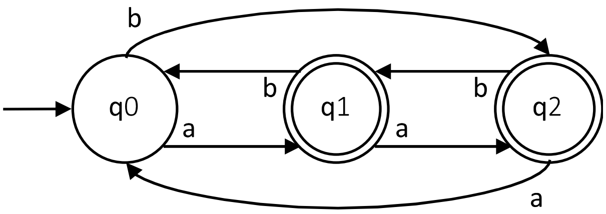
2. Give a set notation description of the language accepted by the automaton depicted in the following diagram. Can you think of a simple verbal characterization of the language?



L = $\{ b^*ab^*(aa^*bb^*)^* \}$
This language has any number of b, followed by one a, followed by any number of b, then followed by any number of a and b in which a appears before b.

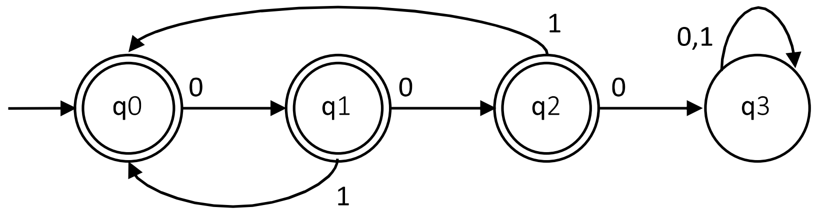
3. Find a deterministic finite automaton for the following language on $\Sigma = \{a, b\}$

$$L = \{\omega \mid (n_a(\omega) - n_b(\omega)) \; mod \; 3 > 0\}$$

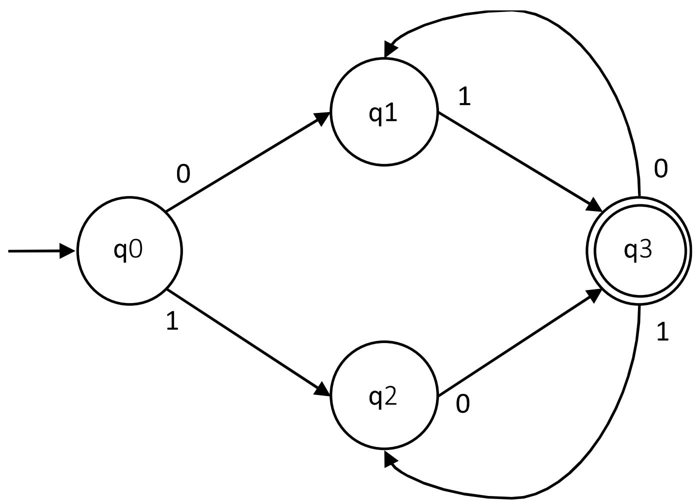


To grader: **please check carefully!** This is correct.

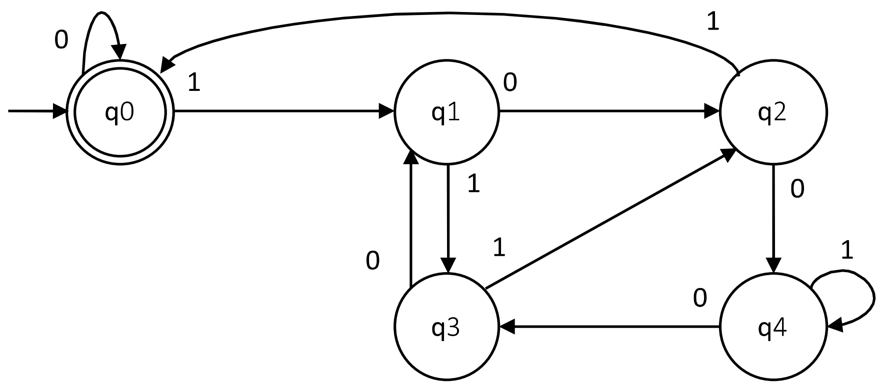
4. Consider the number of strings on {0, 1} defined by the requirement below. For each construct a dfa.
a. Every 00 is followed by a 1. For example, the strings 101, 0010, 0010011001 are in the language, but 0001 and 00100 are not.



b. The leftmost symbol differs from the rightmost one.

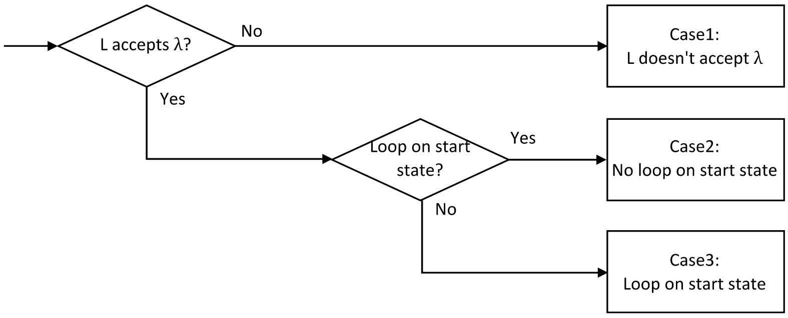


5. Construct a dfa that accepts strings on {0, 1} if and only if the value of the string, interpreted as a binary representation of an integer, is zero modulo five. For example, 0101 and 1111, representing the integers 5 and 15, respectively, are to be accepted.



6. Show that if L is regular, so is $L - \{\lambda\}$.

If there exists a DFA for $L - \{\lambda\}$, $L - \{\lambda\}$ is regular.

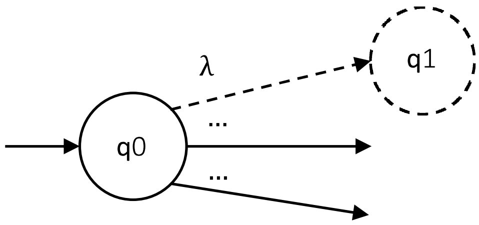


Case1: L doesn't accept λ

If L doesn't accept λ, there is no problem.

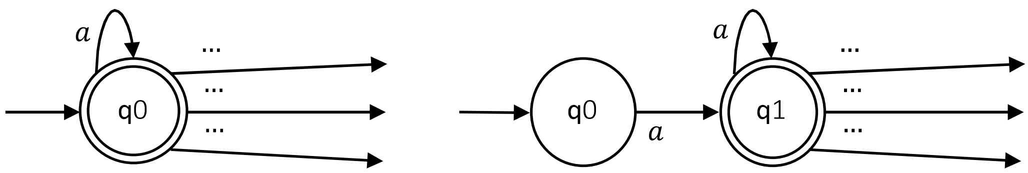
Case2: No loop on start state

If there is a state that accepts λ from the starting state, just remove the accepting state from the starting state and make it nonaccepting state.



Case3: Loop on start state

Assume we have the self-loop on the starting state, that accepts λ. In such a case, remove the accepting property from the starting state and add an extra state to the DFA which takes the transition from the starting state. Now the acceptance of λ automatically removed.



Hence, if L is regular, so is $L - \{\lambda\}$.