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CMPT440 - Formal Languages and Computability
Assignment 2 - Deterministic Finite Automata

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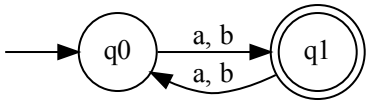
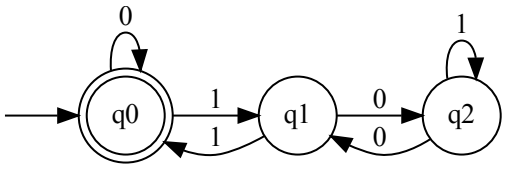
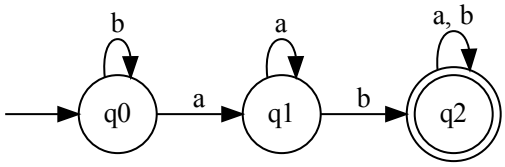
1. **Webber Chap. 2 Exercise 5**
   Draw the DFA diagram for each of the following formal DFAs definitions:



(a)



(b)



(c)

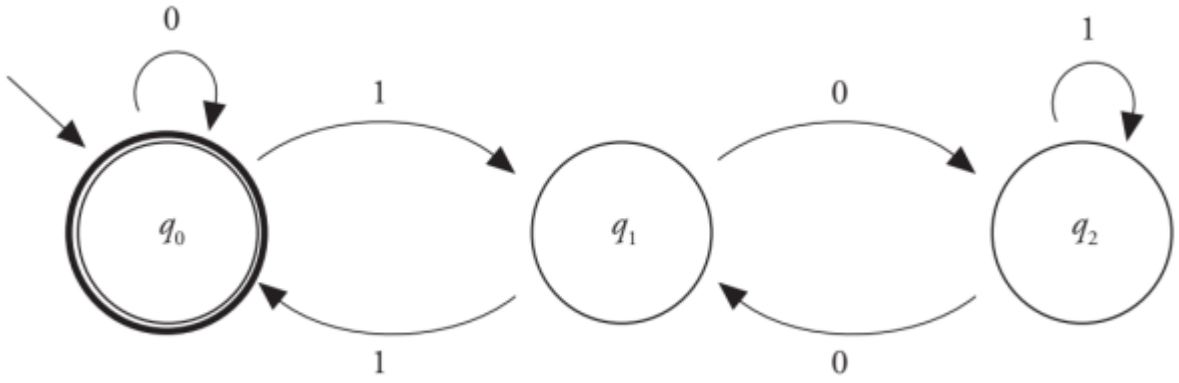
2. **Webber Chap. 2 Exercise 6**
   State each of the following DFAs formally, as a 5-tuple.

   (a) $M = (\{q_0, q_1\}, \{a, b\}, \{\delta(q_0, a) = q_1, \delta(q_0, b) = q_1, \delta(q_1, a) = q_1, \delta(q_1, b) = q_1\}, q_0, \{q_1\})$

   (b) $M = (\{q_0, q_1\}, \{a, b\}, \{\delta(q_0, a) = q_0, \delta(q_0, b) = q_1, \delta(q_1, a) = q_1, \delta(q_1, b) = q_0\}, q_0, \{q_1\})$

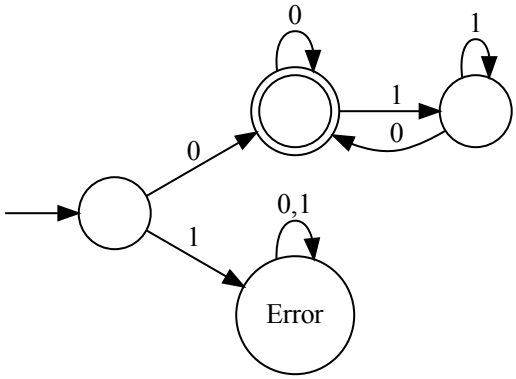
   (c) $M = (\{q_0, q_1, q_2\}, \{0, 1\}, \{\delta(q_0, 0) = q_1, \delta(q_0, 1) = q_2, \delta(q_1, 0) = q_1, \delta(q_1, 1) = q_1, \delta(q_2, 0) = q_2, \delta(q_2, 1) = q_2\}, q_0, \{q_0, q_2\})$

3. **Webber Chap. 2 Exercise 8**
   Evaluate each of these expressions for the following DFA:

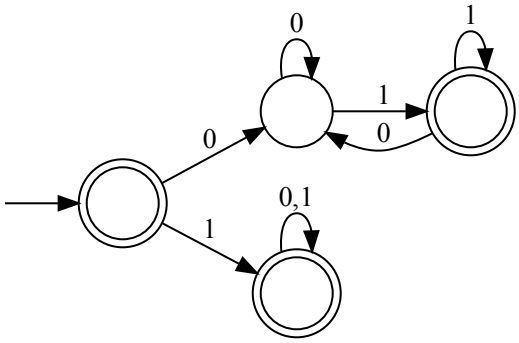


   (a) $\delta(q_2, 0)$ = `q1, rejected`
   (b) $\delta^*(q_0, 010)$ = `q2, rejected`
   (c) $\delta(\delta^*(q_1, 010), 1)$ = `q0, accepted`
   (d) $\delta^*(q_2, \epsilon)$ = `q2, rejected`
   (e) $\delta^*(q_2, 1101)$ = `q0, accepted`
   (f) $\delta^*(q_2, 110111)$ = `q0, accepted`

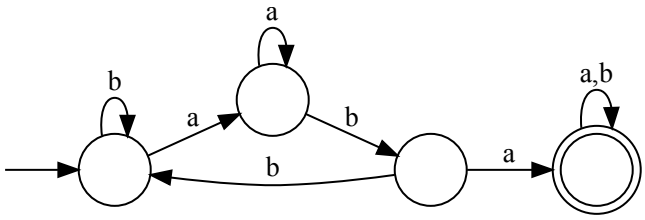
4. **Webber Chap. 3 Exercise 1**
   Draw DFAs for the following languages:



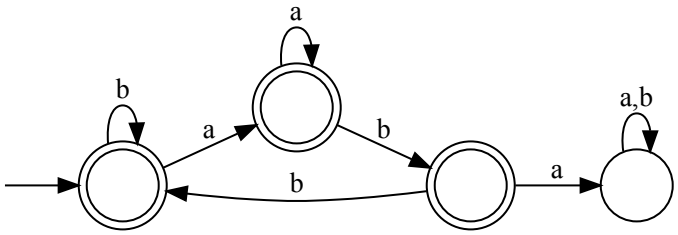
   (a)



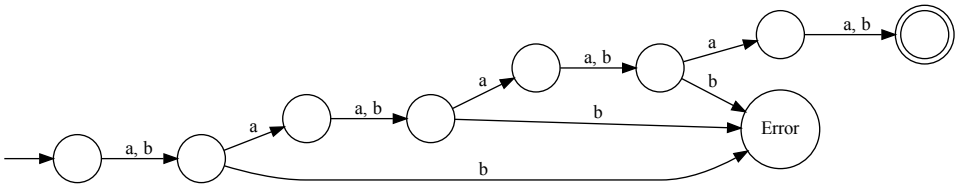
(b)



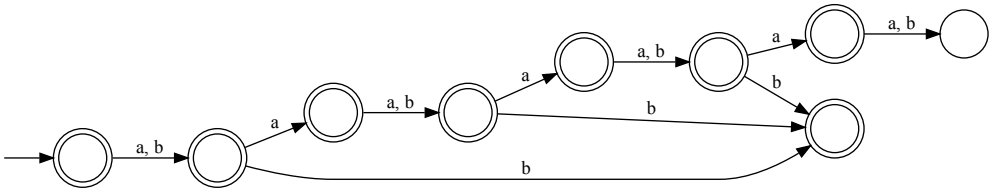
(c)



(d)

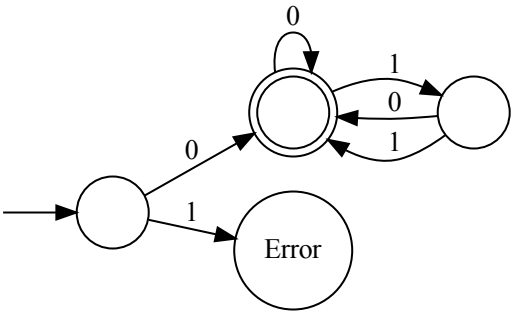


(e)

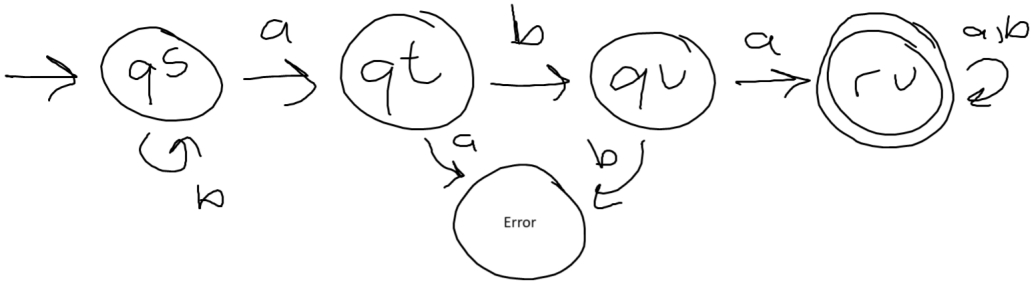


(f)

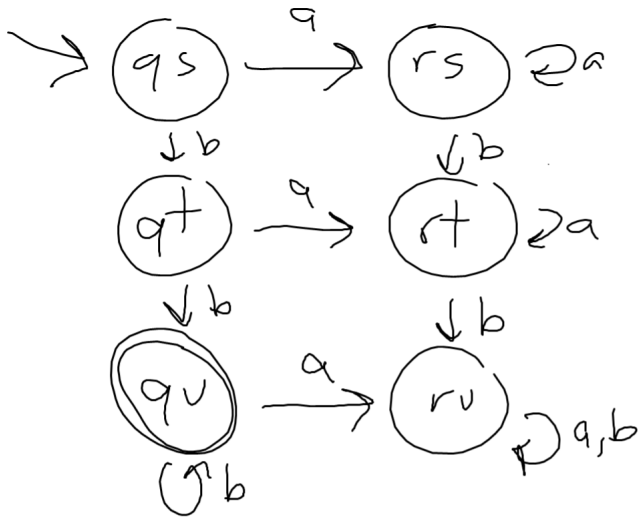
5. **Webber Chap. 3 Exercise 2**
The DFA constructed for the example in Section 3.2 accepts the language of strings over the alphabet 0, 1 that start and end with a 0. It is not, however, the smallest DFA to do so. Draw a DFA for the same language, using as few states as possible.



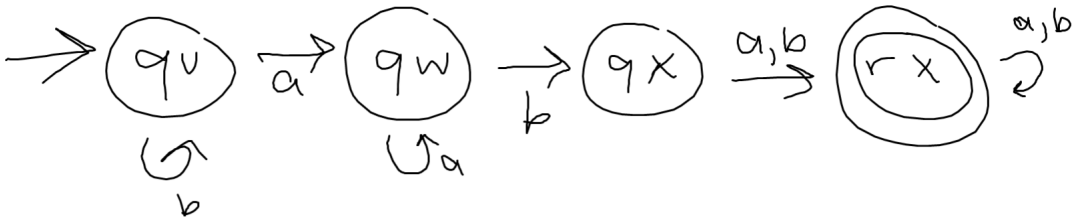
6. **Webber Chap. 3 Exercise 4**
Consider the following three DFAs and the languages they define: Apply the product construction to create DFAs for each of the following languages. Label each state with the pair of states to which it corresponds. You do not need to show unreachable states.



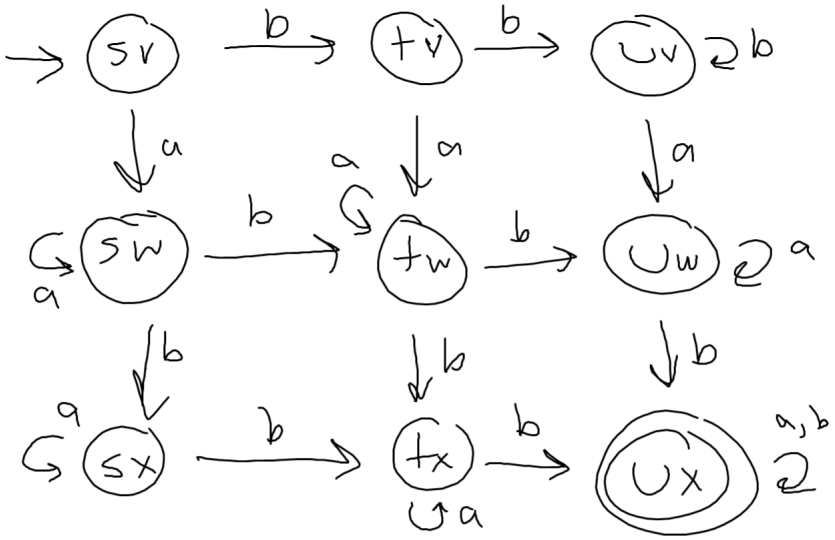
(a)



(b)

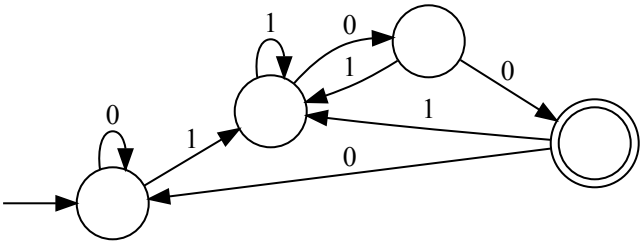


(c)



(d)

7. **Webber Chap. 3 Exercise 9**
   Draw a DFA that accepts the language of strings that are binary representations of numbers that are divisible by 4.


1
0
1
0
0
1
1
0