Converting a Non-deterministic Finite Automaton to a Deterministic Finite Automaton

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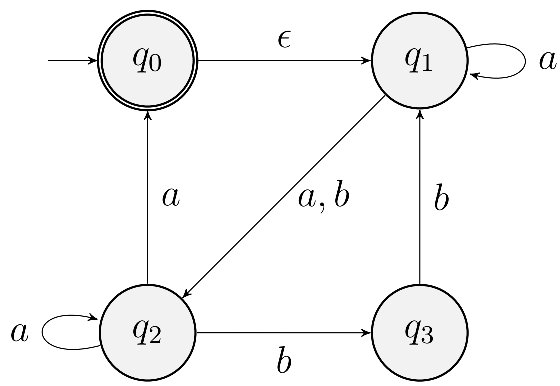
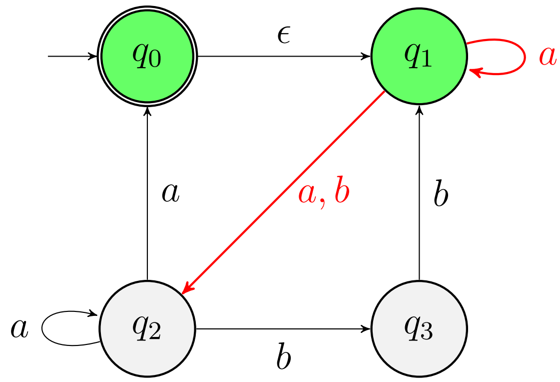
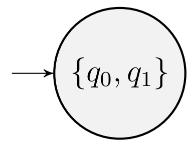
I am using the following NFA for this recitation.



Step 1: Determine the DFA's Start State

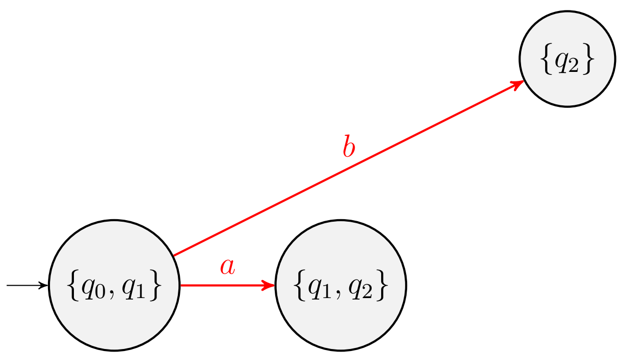
First, find out all possible states the computation can start at, and make a starting state in your DFA with that set. In this case, the epsilon transition from the start state to q_1 makes it possible to start the computation from either q_0 or q_1.





Step 2: Explore Transitions from the Start State

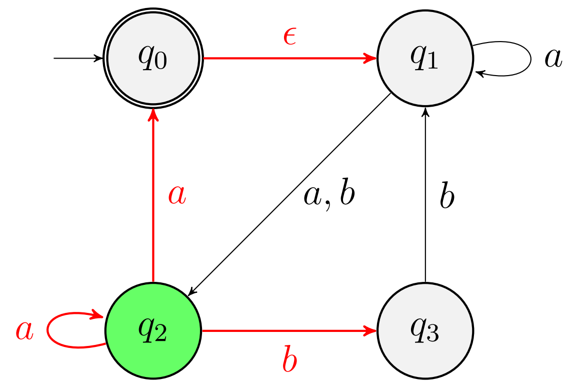
Now, try to figure out the states you could reach by consuming the symbols at states q_0 and q_1. q_0 does not contribute to the set, but q_1 does. By consuming an a, we can either stay at q_1 or move to q_2. With b, there is a single path all computations will have to take, and that is towards q_2.



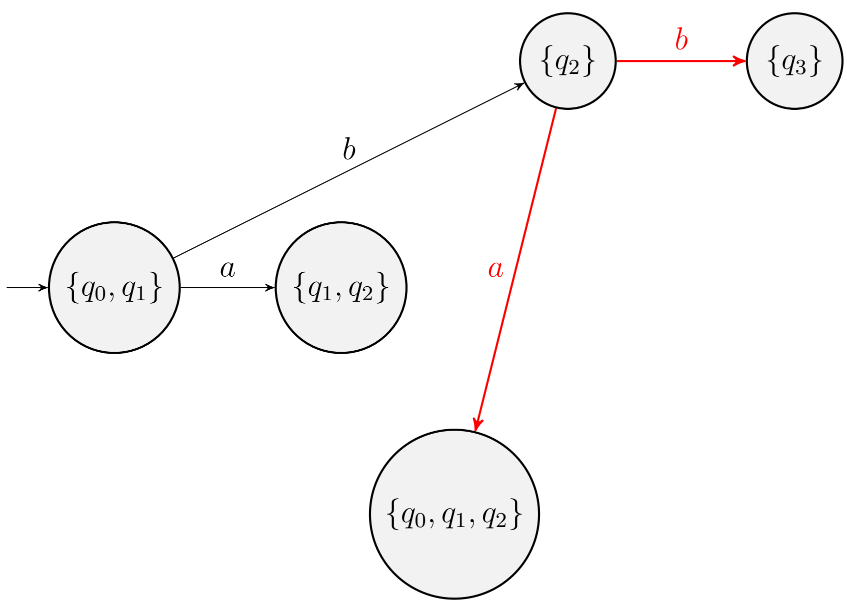
Step 3: Recursively Explore New States

We repeat the same steps on the new states we generated.

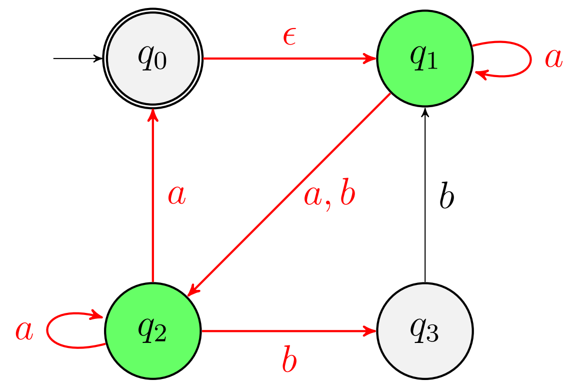
Transitions from state $\{q_2\}$

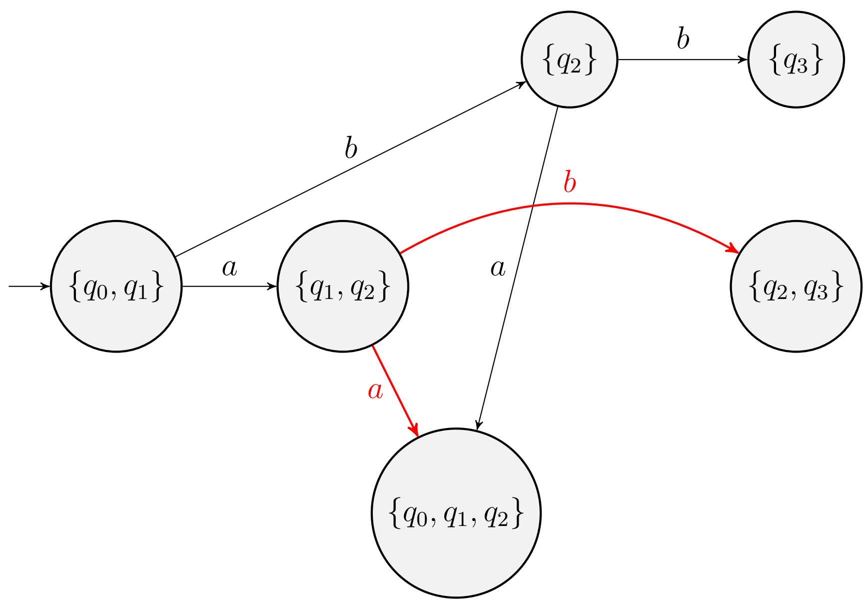


Consuming a can take us to q_2 and q_0, but since there is an epsilon transition from q_0 to q_1, we could end up at q_1 as well. So the new transitions to add in our DFA are:



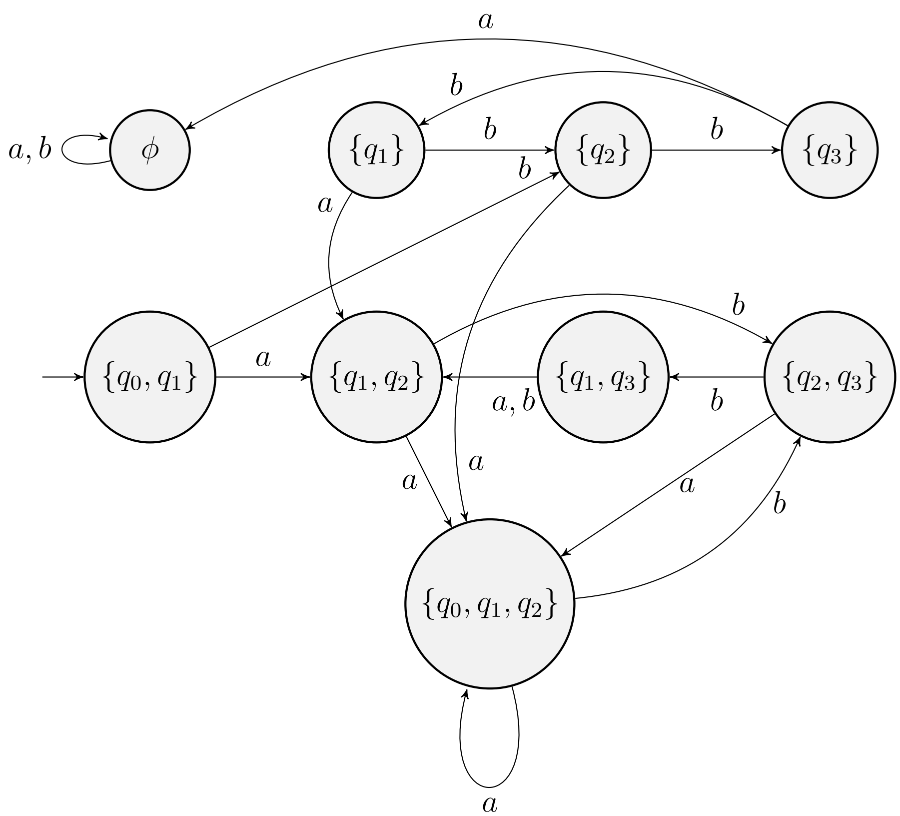
Transitions from state $\{q_1, q_2\}$





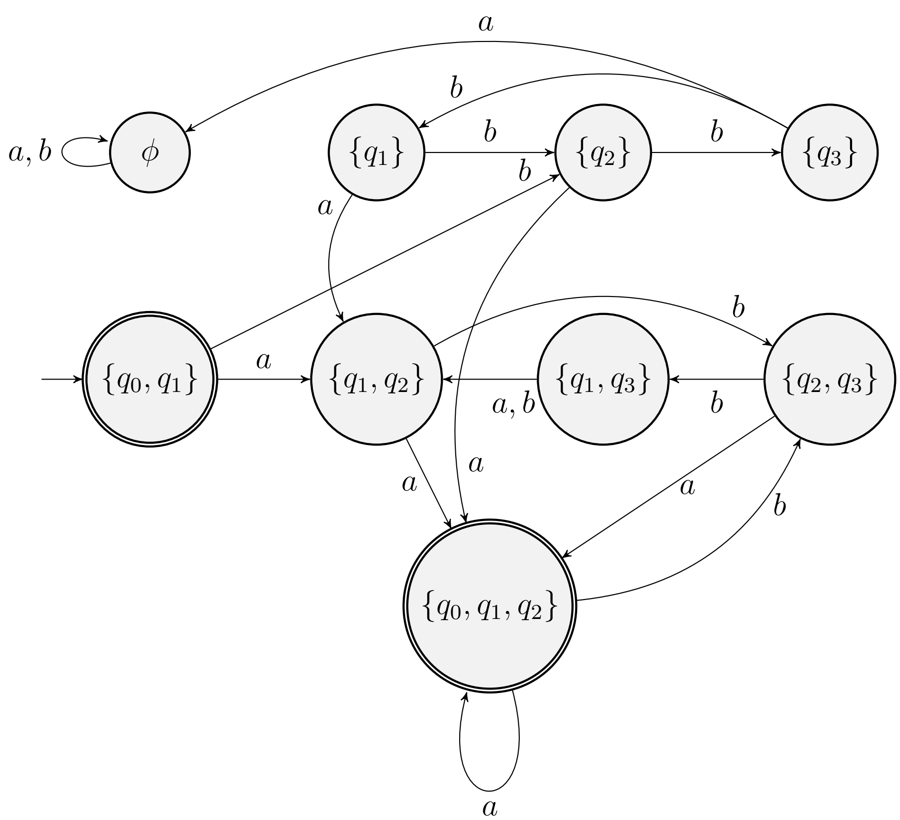
Step 4: Complete the DFA

Continue the steps on all newly generated states until the DFA is complete (no state has missing transitions).



Step 5: Identify the Final (Accepting) States

And finally, double circle every state that contains ANY accepting state from the original NFA. In the original NFA, q_0 was the only accepting state. Therefore, any state in our new DFA that contains q_0 becomes an accepting state.



References

Easy Theory (Ryan Dougherty) - youtube.com/watch?v=jMxuL4Xzi_A