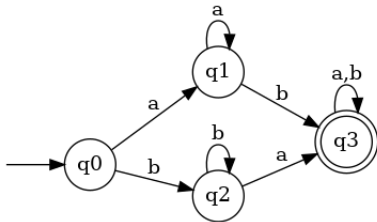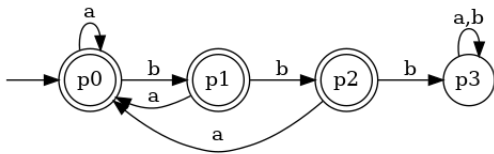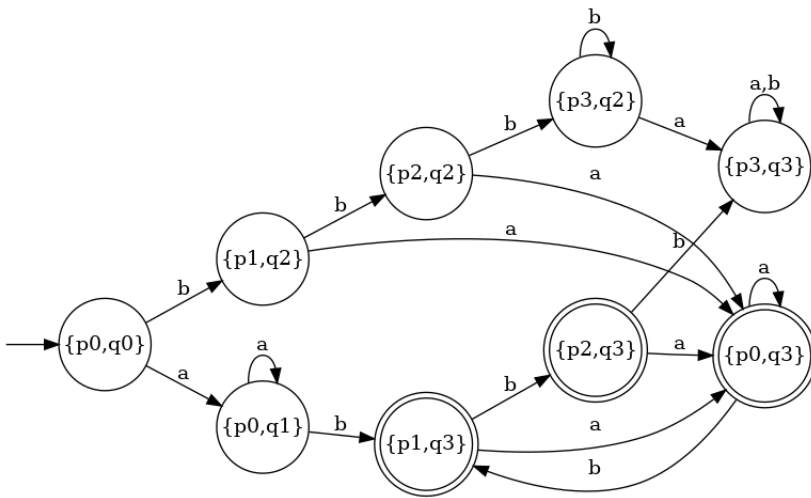Build an NFA accepting the intersection of the languages accepted by the DFAs shown.





Answer:



Discussion:

First ensure that these are complete DFAs — that there is a transition from every state for each symbol in the alphabet. If not, add a trap state and add the missing transitions to connect to that trap state. The two DFAs in the example are complete, so we can proceed.

The idea is to move through the two machines simultaneously, so we construct the new machine to have states corresponding to pairs of states $\{p_i, q_i\}$, one from each machine.
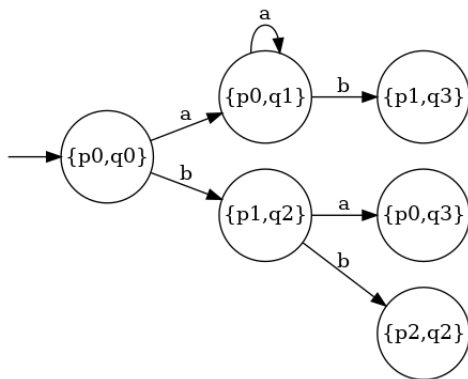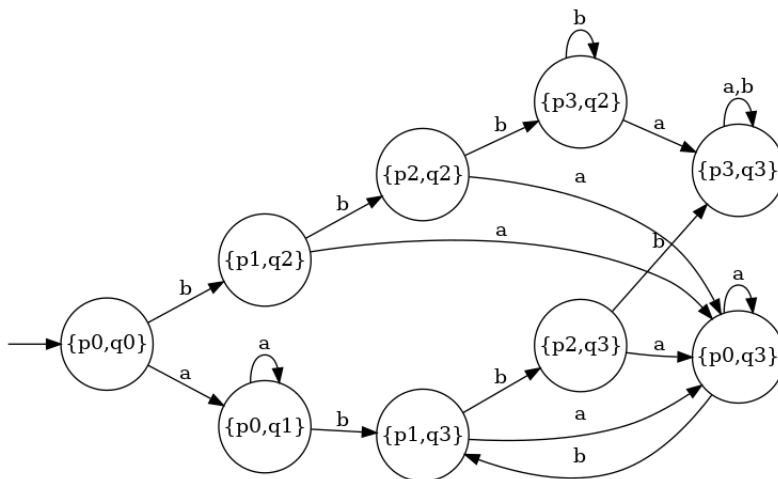
Start with the start states:
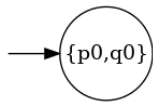
Then add transitions for each symbol from the start state. $p_0 \xrightarrow{a} p_0$ and $q_0 \xrightarrow{a} q_1$; $p_0 \xrightarrow{b} p_1$ and $q_0 \xrightarrow{b} q_2$.
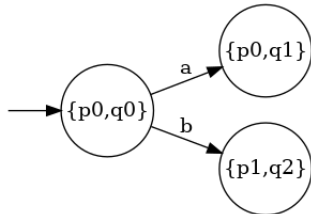


Repeat:



And so forth, until all transitions have been accounted for.

Finally, only accept strings which end in final states in both machines — so the final states of the new machine are those corresponding to final states in both machines. That means $q_3$ must be involved, as well as $p_0$, $p_1$, or $p_2$.