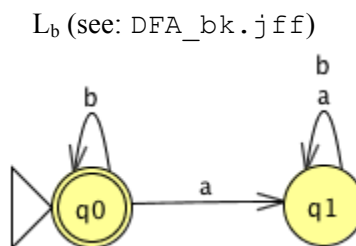
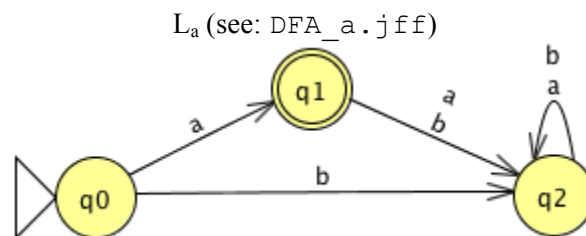


Example: Combine Two Automata Using JFLAP “Combine Automata” Feature_{JP}

Consider the language L over the alphabet $\{a, b\}$ comprised of all strings that have exactly one a , appearing as the initial symbol of the string, and which may have zero or more b symbols following that initial a .

$$L = \{a, ab, abb, abbb, \dots\}$$

This language may be seen as the concatenation of language $L_a \{a\}$ and language $L_b \{\epsilon, b, bb, bbb, bbbb, \dots\}$. L_a may be represented by regular expression a and language L_b by regular expression b^* . They may also be represented by the following DFA.

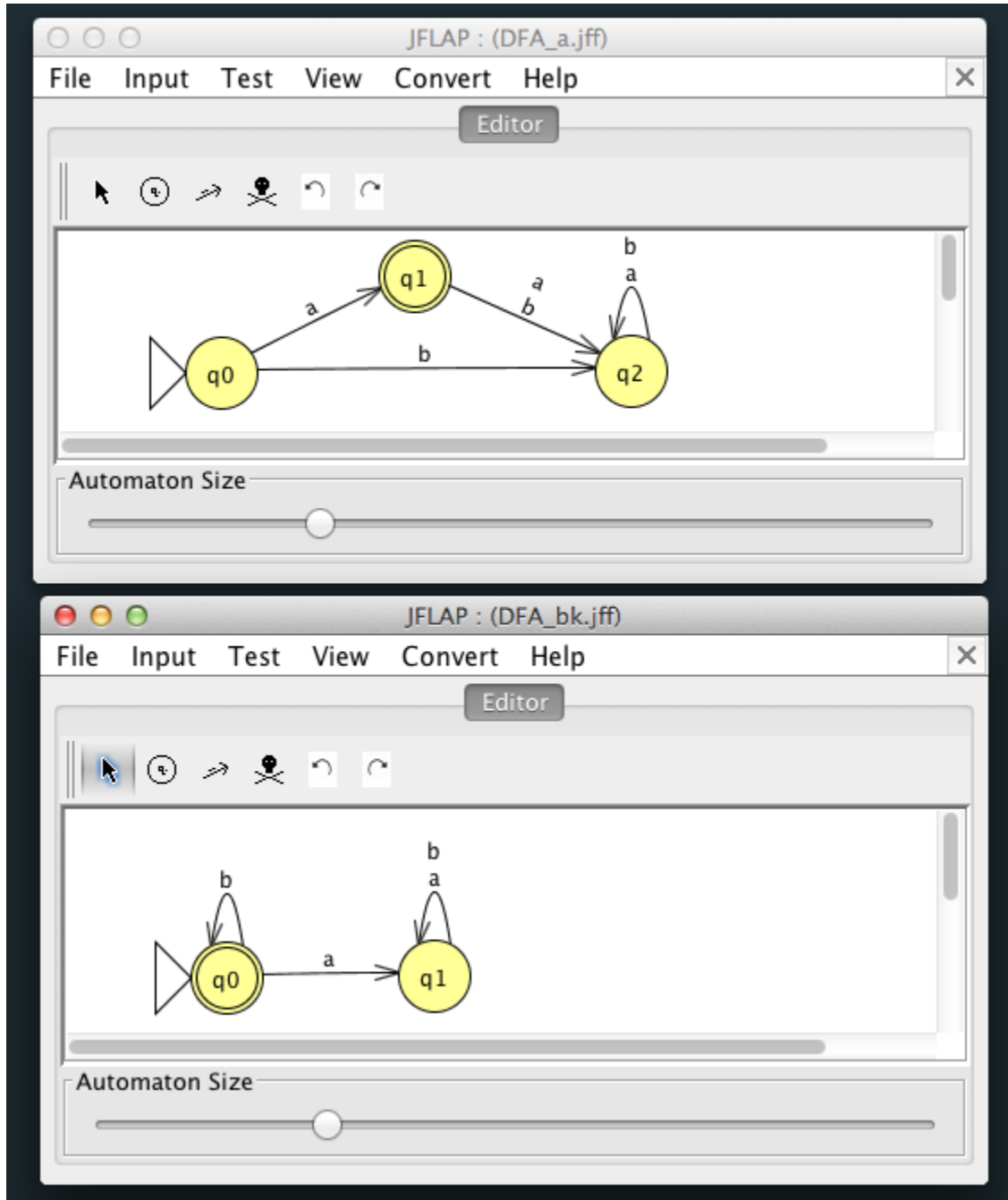


TASK

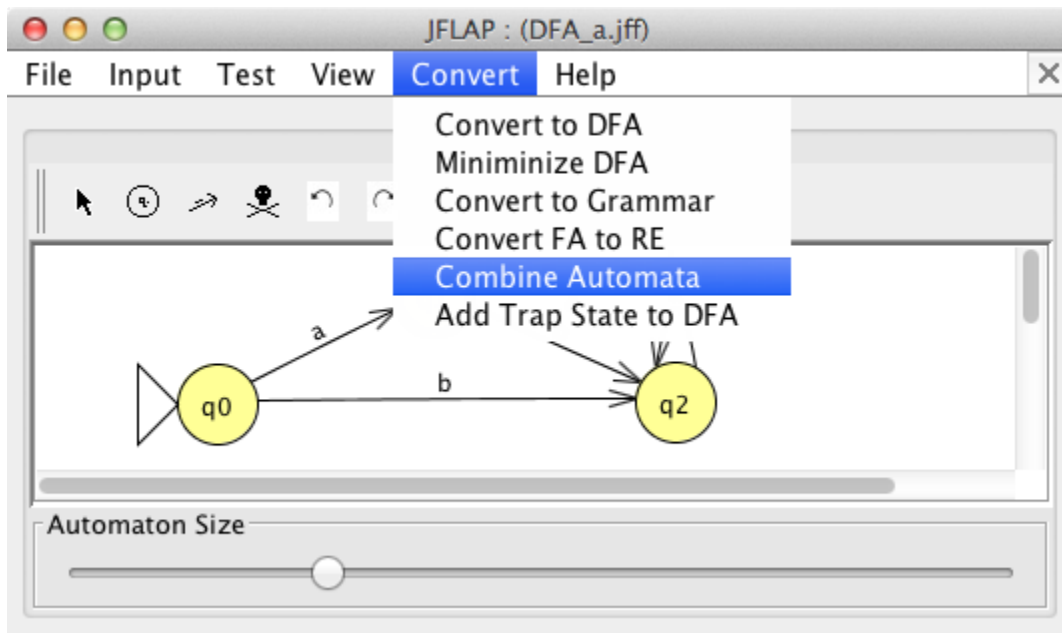
Use the JFLAP *Combine Automata* feature to create an NFA that is the concatenation of these two DFA.

Sample Solution

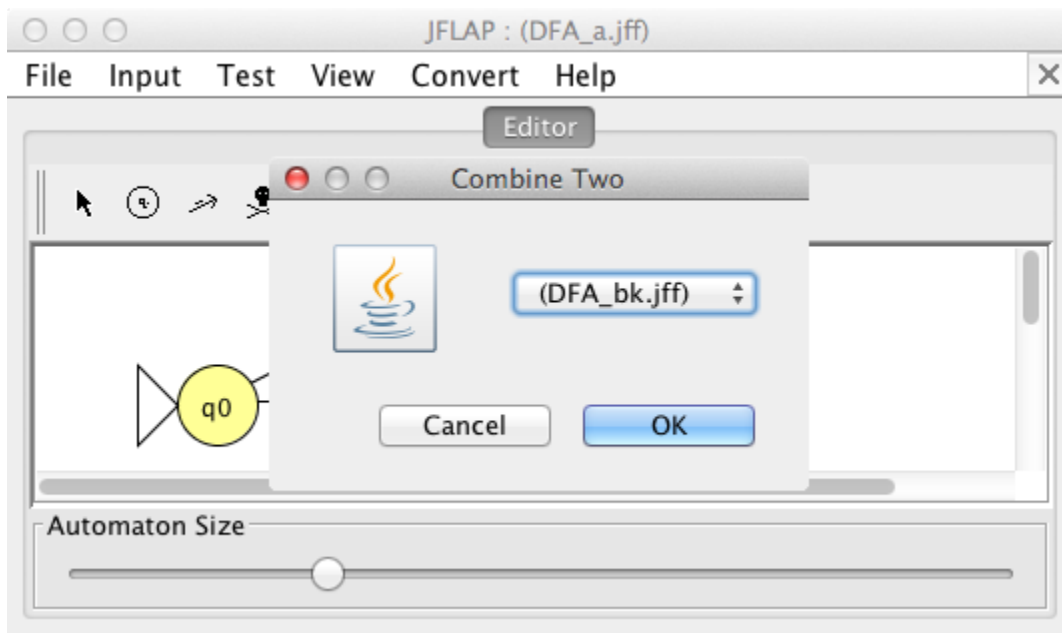
1. Begin by creating these two DFA (or opening the files if provided).



2. Select the *Convert > Combine Automata* menu item from one of the windows.

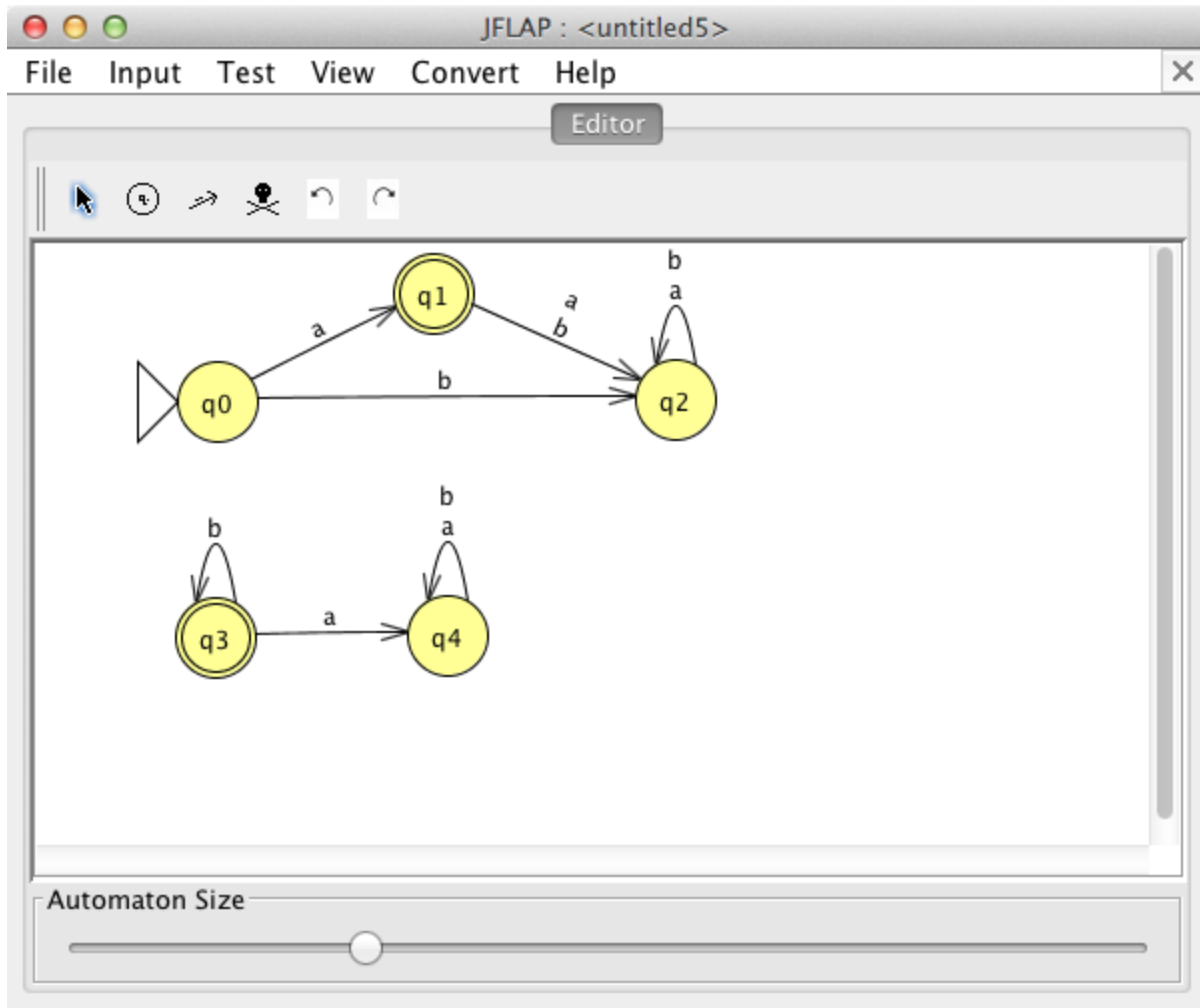


This should result in a new dialog being displayed, entitled "Combine Two".



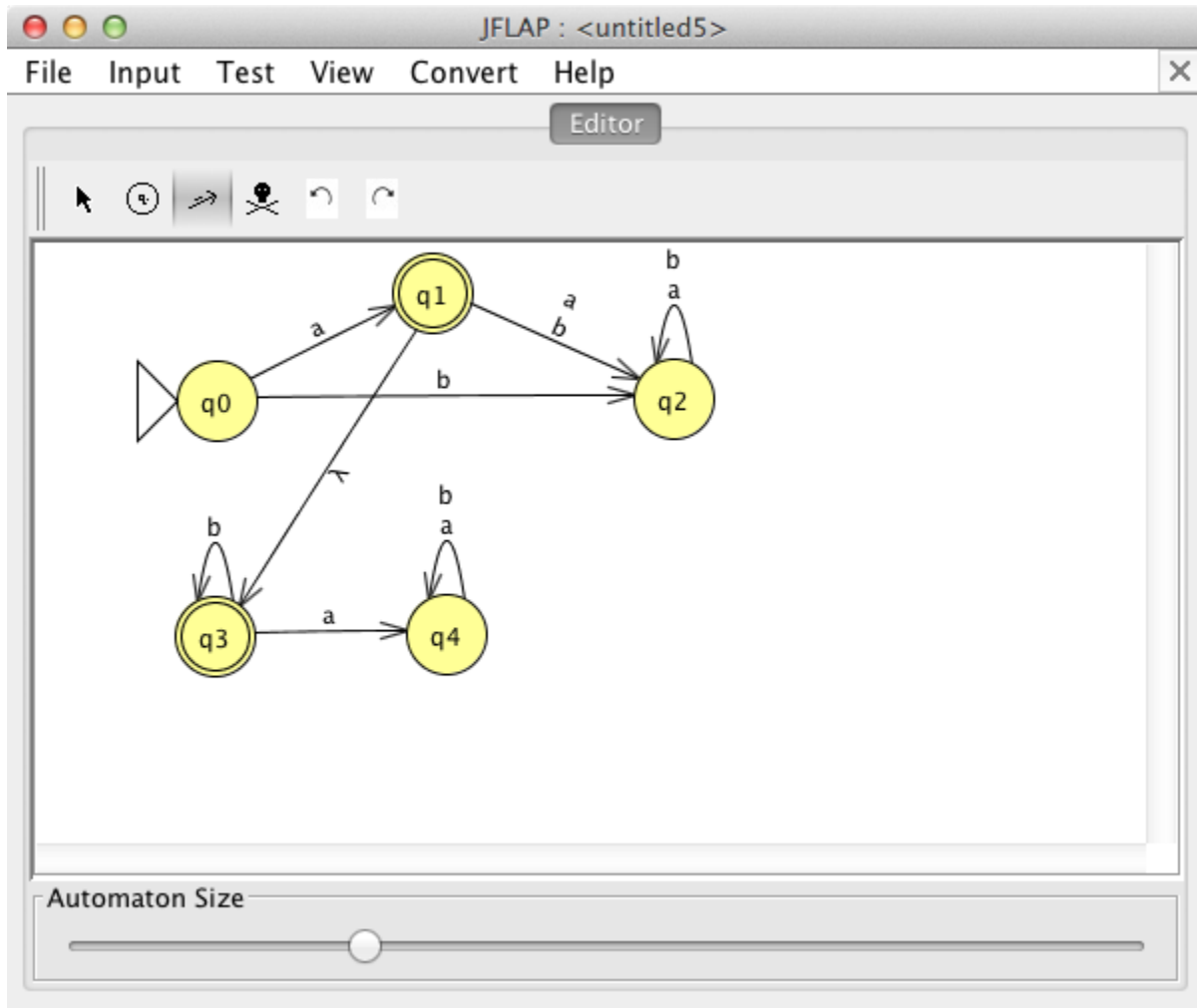
3. Ensure that the other DFA is selected in the drop-down menu (in this case, DFA_bk.jff) and select OK.

The dialog should disappear and a new automaton editor window should be created containing both automata.



Note that the copy of the automaton from whose editor you initiated the “Combine Automata” operation remains unchanged. The copy of the other automaton has lost its initial state designator and the state labels have been changed to make them unique, but is otherwise structurally the same.

4. Represent the concatenation of these two languages by attaching the final state of the first to the (previously) initial state of the second with an ϵ -transition.



5. Check the resultant NFA using a set of known accepted and rejected strings.

The screenshot shows the JFLAP software interface. On the left, an NFA diagram is displayed with five states: q0 (start), q1, q2, q3, and q4. Transitions are: q0 to q1 on 'a', q0 to q2 on 'b', q1 to q2 on 'a', q1 to q3 on 'b', q2 to q1 on 'b', q2 to q2 on 'a', q3 to q3 on 'b', q3 to q4 on 'a', and q4 to q4 on 'a'. On the right, a table shows the results of testing various strings. The table has two columns: 'Input' and 'Result'. The results are as follows:

Input	Result
	Reject
a	Accept
ab	Accept
abb	Accept
abbb	Accept
abbbb	Accept
b	Reject
ba	Reject
aa	Reject
aab	Reject
bab	Reject
bbb	Reject
abbba	Reject

At the bottom of the interface, there are buttons for 'Load Inputs', 'Run Inputs', 'Clear', and 'Enter Lambda'.

(See: NFA_abk.jff)

You may also check the resultant NFA with the regular expression ab^* by (i) entering the expression ab^* using the JFLAP Regular Expression Editor, (ii) using “Convert > RE to FA” with “Step to Completion” and “Export”, and (iii) “Text > Compare Equivalence”.

References

JFLAP Tutorial, *Combining Automata*
<http://www.jflap.org/tutorial/fa/combine/index.html>
 [Accessed 1 July 2014]