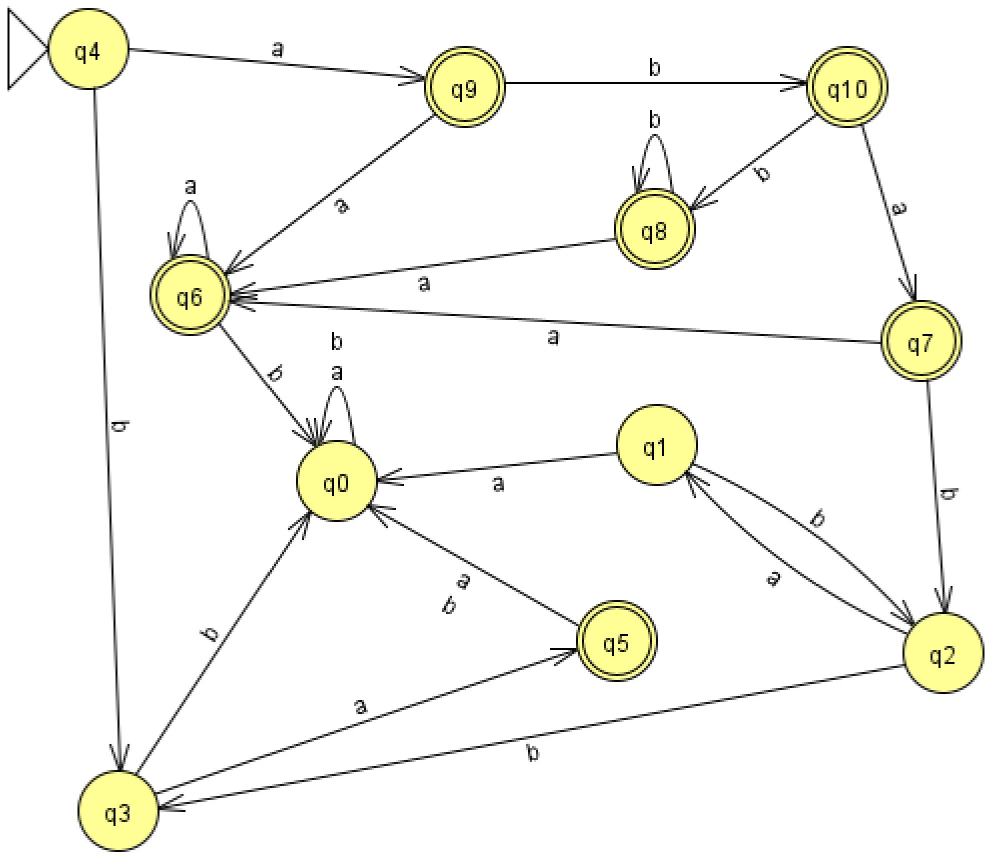
A) Complete problem 7 on page 95. Note that when the problem says "DFA" it means the transition graph.

7. Find dfa's that accept the following languages:

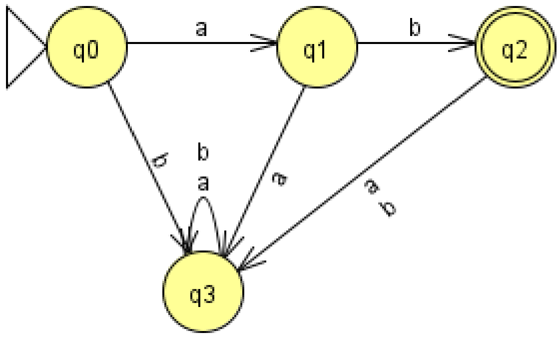
(a). $L = L(ab^*a^*) \cup L((ab)^*ba)$

Answer. The DFA is shown below:



(b). $L = L(ab^*a^*) \cap L((b)^*ab)$

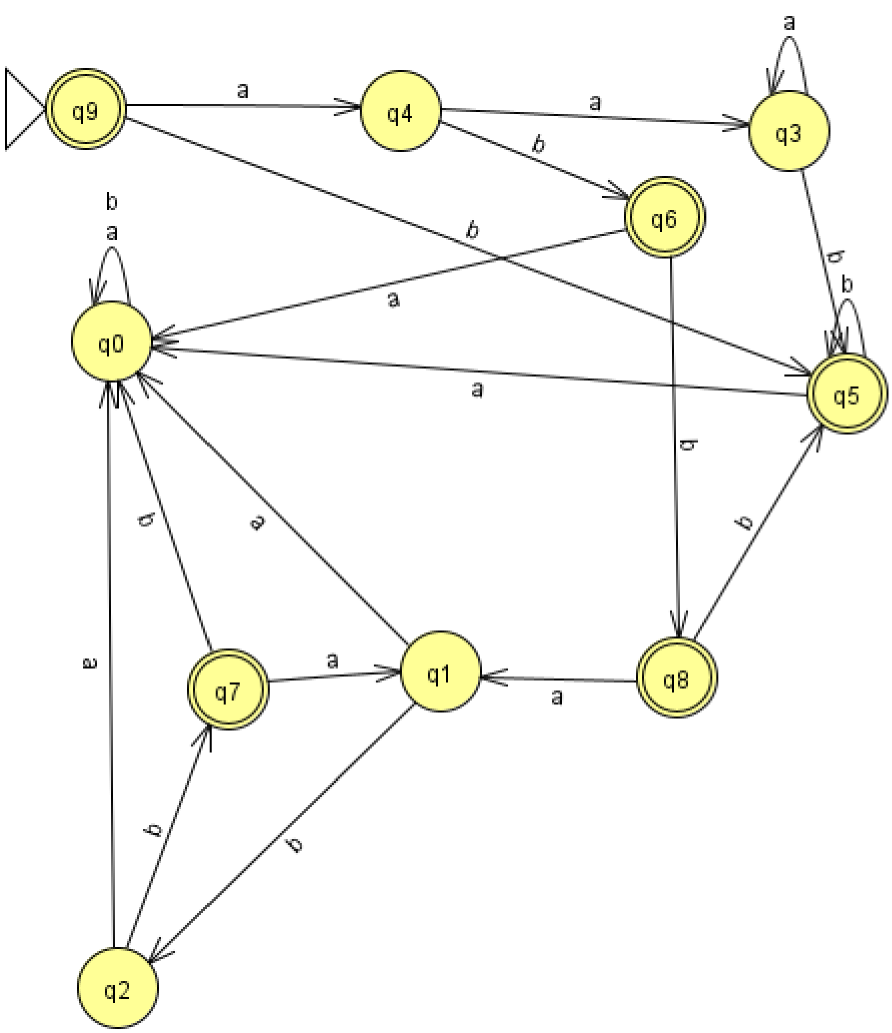
Answer. The language can be simplified. Since the first language requires an a as the first input, the second language must start with an a as well (it must start with 0 b's). Next, since the second language requires a b following the a, the first language must have one b followed by 0 a's. Thus the language that is accepted is $L = L(ab^*a^*) \cap L((b)^*ab) = L(ab)$. The DFA is shown below:



B) Complete problems 8 and 9 page 96. Show the work minimizing the DFA. Note that when the problem says “DFA” it means the transition graph.

8. Find the minimal dfa that accepts $L(abb)^* \cup L(a^*bb^*)$

Answer. The DFA is shown below:



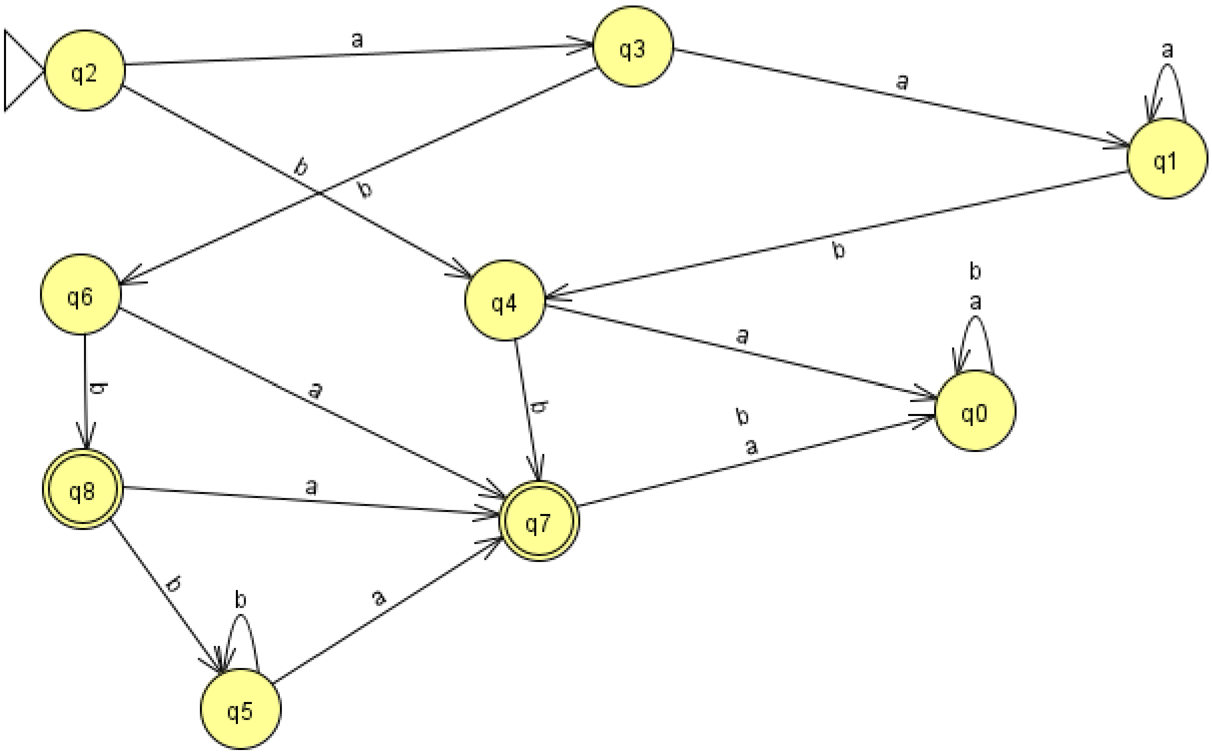
To begin, the following notation will be used: A numerical value (0 through 9) will refer to it's corresponding state (q_0 through q_9). The pairs (n, m) where q_n is a final state and q_m is not a final state are all marked as distinguishable. The table below shows the state pairs and the set of states corresponding to the input, for example the pair $(0, 1)$ are the states q_0 and q_1 and the set $a = \{0\}$ is the set of states reached after the value a is consumed, which is the state q_0 for both states. The table of all pairs and inputs, not already marked as distinguishable, is shown below:

Pairs	Sets
$(0,1)$	$a = \{0\}, b = \{0,2\}$
$(0,2)$	$a = \{0\}, b = \{0,7\}$
$(0,3)$	$a = \{0\}, b = \{0,5\}$
$(0,4)$	$a = \{0,3\}, b = \{0,6\}$
$(1,2)$	$a = \{0\}, b = \{2,7\}$
$(1,3)$	$a = \{0,3\}, b = \{2,5\}$
$(1,4)$	$a = \{0,3\}, b = \{2,6\}$
$(2,3)$	$a = \{0,3\}, b = \{7,5\}$
$(2,4)$	$a = \{0,3\}, b = \{7,6\}$
$(3,4)$	$a = \{3\}, b = \{5,6\}$
$(5,6)$	$a = \{0\}, b = \{5,0\}$
$(5,7)$	$a = \{0,1\}, b = \{5,0\}$
$(5,8)$	$a = \{0,1\}, b = \{5\}$
$(5,9)$	$a = \{0,4\}, b = \{5\}$
$(6,7)$	$a = \{0,1\}, b = \{0\}$
$(6,8)$	$a = \{0,1\}, b = \{0,5\}$
$(6,9)$	$a = \{0,4\}, b = \{0,5\}$
$(7,8)$	$a = \{1\}, b = \{0,5\}$
$(7,9)$	$a = \{1,4\}, b = \{0,5\}$
$(8,9)$	$a = \{1,4\}, b = \{5\}$

Therefore, since all state pairs have at least one input with 2 states, all the states are distinguishable (and marked as distinguishable). So, the graph is minimized.

9. Find the minimal dfa that accepts $L(a^*bb) \cup L(ab^*ba)$

Answer. The DFA is shown below:



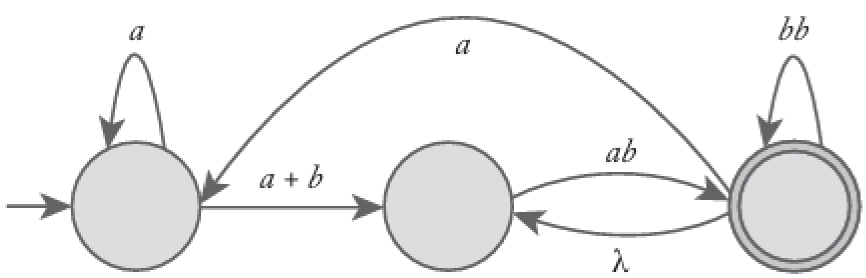
The same notation will be used as the previous question and states pairs (n, m) where q_n is a final state and q_m is not a final state are all marked as distinguishable. The table of all pairs and inputs, not already marked as distinguishable, is shown below:

Pairs	Sets
$(0,1)$	$a = \{0,1\}, b = \{0,4\}$
$(0,2)$	$a = \{0,3\}, b = \{0,4\}$
$(0,3)$	$a = \{0,1\}, b = \{0,6\}$
$(0,4)$	$a = \{0\}, b = \{0,7\}$
$(0,5)$	$a = \{0,7\}, b = \{0,5\}$
$(0,6)$	$a = \{0,7\}, b = \{0,8\}$
$(1,2)$	$a = \{1,3\}, b = \{4\}$
$(1,3)$	$a = \{1\}, b = \{4,6\}$
$(1,4)$	$a = \{1,0\}, b = \{4,7\}$
$(1,5)$	$a = \{1,7\}, b = \{4,5\}$
$(1,6)$	$a = \{1,7\}, b = \{4,8\}$
$(2,3)$	$a = \{3,1\}, b = \{4,6\}$
$(2,4)$	$a = \{3,0\}, b = \{4,7\}$
$(2,5)$	$a = \{3,7\}, b = \{4,5\}$
$(2,6)$	$a = \{3,7\}, b = \{4,8\}$
$(3,4)$	$a = \{1,0\}, b = \{6,7\}$
$(3,5)$	$a = \{1,7\}, b = \{6,5\}$
$(3,6)$	$a = \{1,7\}, b = \{6,8\}$
$(4,5)$	$a = \{0,7\}, b = \{7,5\}$
$(4,6)$	$a = \{0,7\}, b = \{7,8\}$
$(5,6)$	$a = \{7\}, b = \{5,8\}$
$(7,8)$	$a = \{0,7\}, b = \{0,5\}$

Therefore, since all state pairs have at least one input with 2 states, all the states are distinguishable (and marked as distinguishable). So, the graph is minimized.

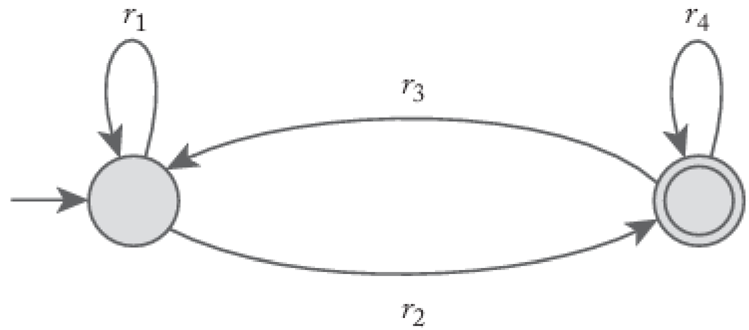
C) Complete problem 10 page 96.

10. Consider the following generalized transition graph.



(a). Find an equivalent generalized transition graph with only two states.

Answer. To begin, let $r_1 = a+(a+b)(ab)a$, $r_2 = (a+b)ab$, $r_3 = a$, and $r_4 = bb+a(a+b)ab$. Then, the generalized transition graph is shown on the next page:



(b). What is the language accepted by this graph?

Answer. The language accepted by this graph is $L = L(r_1^* r_2 (r_4 + r_3 r_1^* r_2)^*)$, where r_1, r_2, r_3, and r_4 is defined in part (a).