CS 340, Fall 2016 — Sep 29th — Exam 1 Name: _____

Note: in all questions, the special symbol ϵ (epsilon) is used to indicate the empty string.

Question 1. [10 points] Specify a regular expression that recognizes the language over the alphabet {**a**, **b**} of all strings that end in either **aba** or **bab**.

Examples of strings in the language:

aba
bab
aaba
abbabab
bbbbaba

Examples of strings not in the language:

ϵ
ab
ba
babaa
ababba

Question 2. [10 points] Specify a regular expression that recognizes the language over the alphabet {**a**, **b**} of all strings with an even number of **b**s.

Examples of strings in the language:

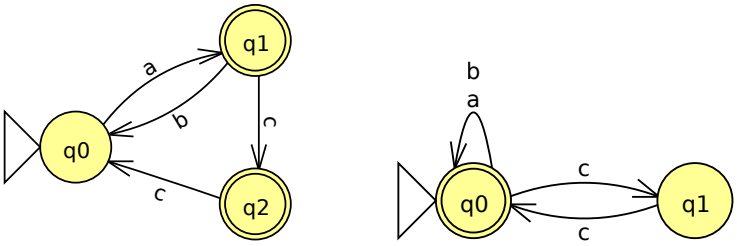
ϵ
bb
abb
abba
aaaabaab

Examples of strings not in the language:

b
bbb
aba
abbaba
bbababab

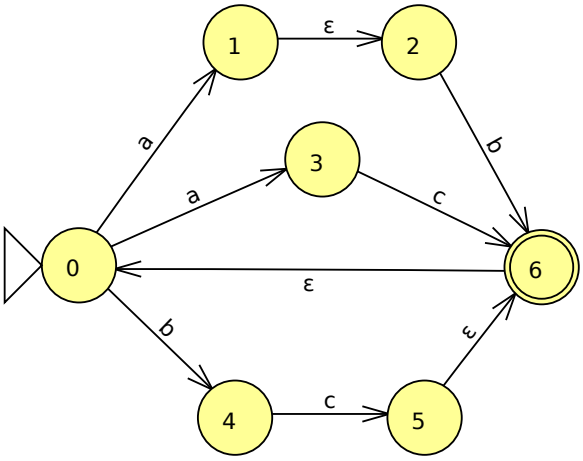
Question 3. [10 points] Create a *deterministic* finite automaton (DFA) that recognizes the language described in Question 1. (See that question for examples of strings in the language and not in the language.) Make sure you indicate the start state and the final state(s), and that each transition has a direction and is labeled with exactly one input symbol.

Question 4. [10 points] Consider the following two DFAs:



Show a finite automaton that recognizes the union of the languages recognized by these two automata. In other words, any string that is accepted by *either* of the automata should be accepted, and any string that is rejected by *both* automata should be rejected. **Hint**: your automaton does not need to be deterministic.

Question 5. [10 points] Consider the following nondeterministic finite automaton (NFA):



Convert this NFA into a deterministic finite automaton (DFA). Show the table mapping sets of NFA states to an equivalent DFA state. Make sure your DFA indicates the start state, final state(s), and that each transition indicates a direction and is labeled with exactly one input symbol.

Question 6. [10 points]

Question 7. [10 points]

Question 8. [10 points]

Question 9. [10 points]