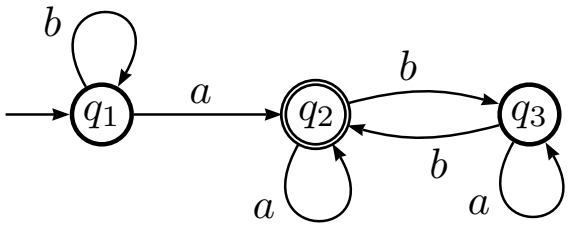
University of New Brunswick
Faculty of Computer Science
CS2333: Computability and Formal Languages
Homework Assignment 2, ***Due Time, Date*** *5:00 PM, January 28, 2022*

Student Name: _____ Matriculation Number: _____

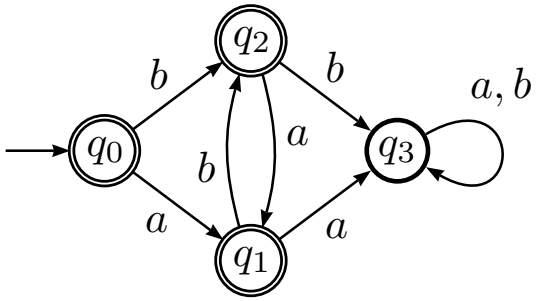
Instructor: Rongxing Lu
The marking scheme is shown in the left margin and [100] constitutes full marks.

[**30**] 1. For each of the following finite automata, give: (i) the set of accept states; (ii) the sequence of states for the string $ababba$; (iii) a description in words of the language of strings accepted by the automaton.

[15] (a)



[15] (b)



[**70**] 2. For each of the following languages over $\{0, 1\}$, draw the state diagram for a deterministic finite automaton that recognizes the language.

[10] (a) $\{w|$ the length of w is one more than a multiple of $3\}$

[10] (b) $\{w|w$ starts with $01\}$

[10] (c) $\{w|w$ starts and ends with the same symbol$\}$

[10] (d) $\{w|w$ contains at most two 0s$\}$

[10] (e) $\{w|w$ starts with 00 and ends with $01\}$

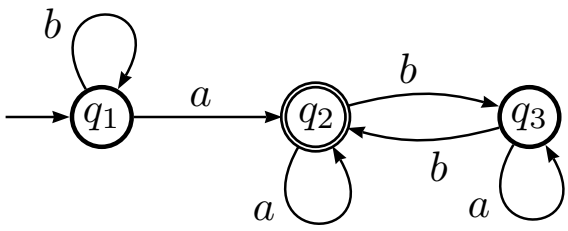
[10] (f) $\{w|w$ has an odd number of 1s and an even number of 0s$\}$

[10] (g) $\{w|w$ has length at least 3 and its third symbol is $0\}$

Solutions.

1. For each of the following finite automata, give: (i) the set of accept states; (ii) the sequence of states for the string $ababba$; (iii) a description in words of the language of strings accepted by the automaton.

   (a)

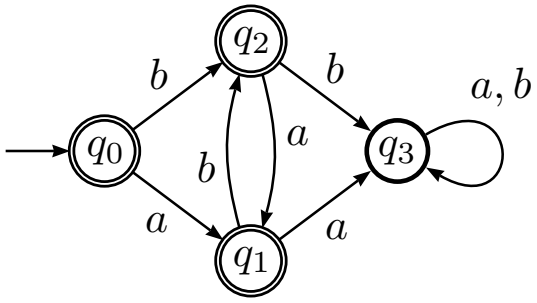


   i. $\{q_2\}$

   ii. $q_1, q_2, q_3, q_3, q_2, q_3, q_3$

   iii. strings that have at least one a and where the number of bs after the first a is even.

   (b)



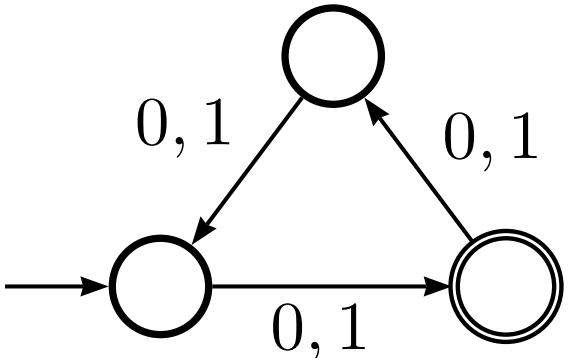
   i. $\{q_0, q_1, q_2\}$

   ii. $q_0, q_1, q_2, q_1, q_2, q_3, q_3$

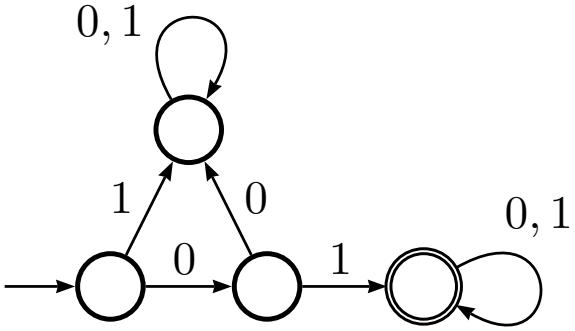
   iii. The language of all strings over $\{a, b\}$ that do not have the same symbol twice consecutively. (Or: The language of all strings over $\{a, b\}$ that alternate symbols.)

2. For each of the following languages over $\{0, 1\}$, draw the state diagram for a deterministic finite automaton that recognizes the language.

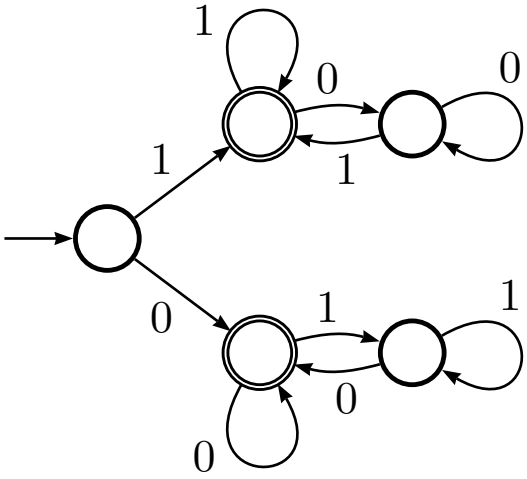
   (a) $\{w|$ the length of w is one more than a multiple of $3\}$



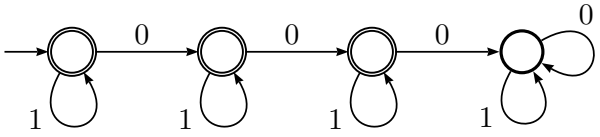
(b) $\{w|w$ starts with 01$\}$



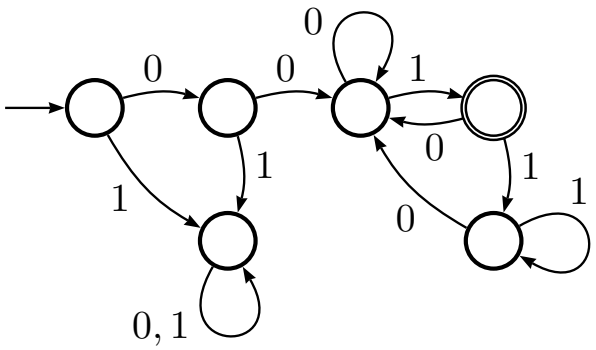
(c) $\{w|w$ starts and ends with the same symbol$\}$



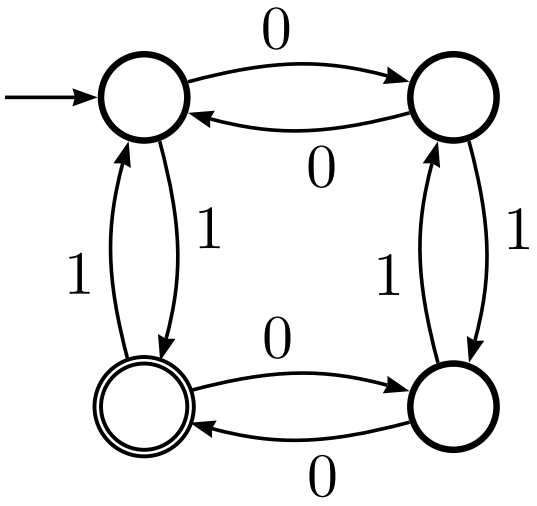
(d) $\{w|w$ contains at most two 0s$\}$



(e) $\{w|w$ starts with 00 and ends with 01$\}$



(f) $\{w|w$ has an odd number of 1s and an even number of 0s$\}$



(g) $\{w|w$ has length at least 3 and its third symbol is 0$\}$