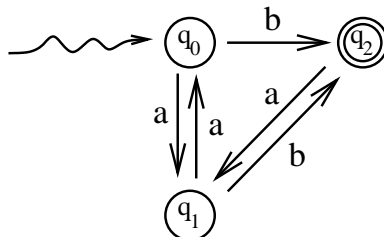# University of Nevada, Las Vegas Computer Science 456/656 Fall 2025
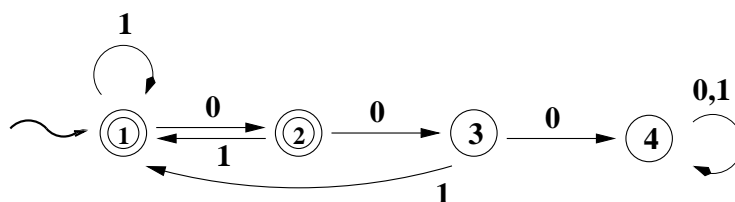## Assignment 1: Due Saturday August 31, 2025, 11:59:59 PM

Name:_____

You are permitted to work in groups, get help from others, read books, and use the internet. Turn in the assignment as instruced by the Teachiing Assistant, Sabrina Wallace `wallace4@cs.unlv.edu`
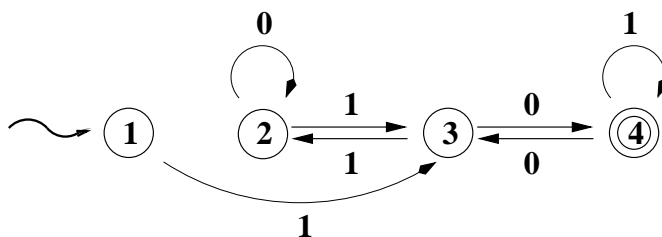
1. Let M_1 be the DFA shown below.

Let M_2 be the DFA shown below.

Let M_3 be the DFA shown below.

Which of the following languages is accepted by M_1? By M_2? By M_3?

   (a) The language of all binary strings in which every substring 00 is followed by 1.

   (b) All strings over $\{a, b\}$ which end in b and which do not contain the substring bb.

   (c) The language of all binary numerals for positive integers equivalent to 2 modulo 3.

   (d) The language of all strings over $\{a, b\}$ in which every b is followed by a.

2. Construct a DFA which accepts the language $\{b^i a b^j : i, j \geq 0\}$, the language of all strings over $\{a, b\}$ which contain exactly one a. Your figure need not show the dead state.

3. Recall that $\emptyset$ is the empty language. If L is some language, what is the concatenation $\emptyset L$?

4. Let $L_1 = \{\lambda\}$. the language consisting of only the empty string. If L_2 is some other language, what is the concatenation $L_1 L_2$?

5. Is concatenation of languages commutative? That is, is the equation $L_1 L_2 = L_2 L_1$ always true?

6. Which of the following is true:

    (a) If L is any language, $L^0 = L$.

    (b) If L is any language, $L^0 = \emptyset$.

    (c) If L is any language, $L^0 = \{\lambda\}$.

    Hint: Think!

7. Does concatenation of languages distribute over union? That is, is $L_1(L_2 + L_3) = L_1 L_2 + L_1 L_3$ always true?

8. What is $\emptyset^*$, the Kleene closure of the empty language?

9. True(T) or False(F).

    i _____ Every language has a grammar.

    ii _____ Every language is finite.

    iii _____ 'Every language is infinite.

    iv _____ Concatenation is commutative. That is, $L_1 L_2 = L_2 L_1$ for any languages L_1 and L_2.

    v _____ Concatenation is associative. That is, $(L_1 L_2)L_3 = L_1(L_2 L_3)$ for any languages L_1, L_2, and L_3.

    vi _____ The intersection of any two regular languages is regular.

    vii _____ The complement of any regular languages is regular.

    viii _____ The Kleene closure of any regular languages is regular.

10. The DFA M_1 shown in Problem 1 is not minimal, that is, it is equivalent to a DFA with fewer states. Can you draw a state diagram of that DFA? Your figure need not show the dead state.