University of Nevada, Las Vegas Computer Science 456/656 Fall 2024

Assignment 2: Due Friday September 13, 2024, 11:59 PM

Name:_____

You are permitted to work in groups, get help from others, read books, and use the internet. You will receive a message from the graduate assistant, Zachary Edwards, telling you how to turn in the assignment.

1. Identify which machine accepts the language defined by each regular expression.

   (i) $a^* + b^*$

   (ii) λ

   (iii) a^*

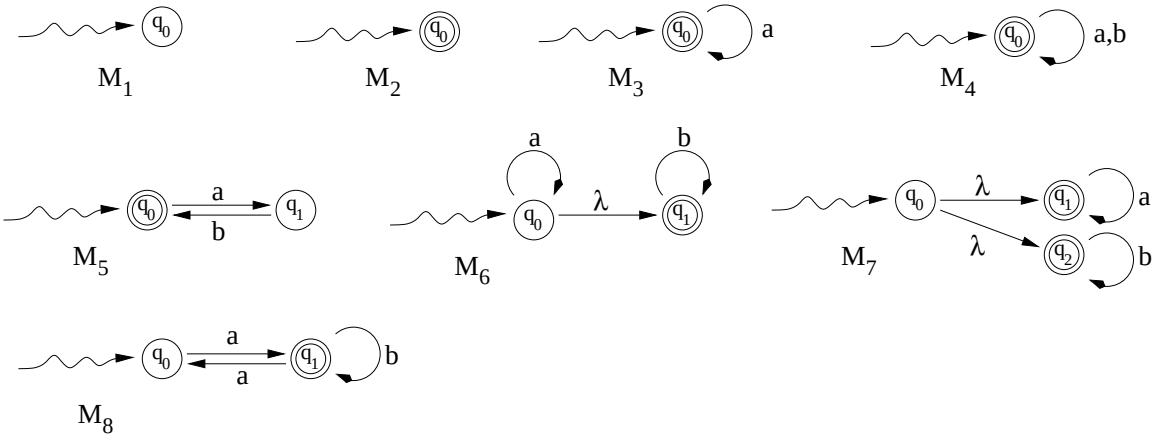
   (iv) $\emptyset$

   (v) $a(aa + b)^*$

   (vi) a^*b^*

   (vii) $(a + b)^*$

   (viii) $(ab)^*$



2. True or False.

   (i) _____ If L is any language, $L + L = L$

   (ii) _____ If L is any language, $L \cap L = L$

   (iii) _____ If L is any language, $\{\lambda\} \in L^*$.

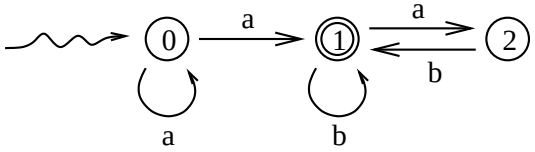
3. Let $L_1 = \{a, ab\}$ and $L_2 = \{a, ba\}$. How many strings are there in the language L_1L_2? _____ How many strings are there in the language L_2L_1? _____

4. True or False. These are harder.

   (a) _____ Any language consisting of all decimal numerals of an arithmetic sequence (for example: $L = \{\langle 5 + 8n\rangle : n \geq 0\} = \{5, 13, 21, 29, 37, 45 \ldots\}$) is regular. Note: the members of L are numerals, not numbers.

(b) _____ Let L_1 be a regular binary language. Let L_2 be the language of all strings obtained from members of L_1 by substituting ab for 0 and c for 1. Then L' must be regular. For example, if $L_1 = \{0, 10, 10011\}$ then $L' = \{ab, cab, cababcc\}$.

5. Any NFA with n states is equivalent to some DFA with at most 2^n states, counting the dead state. Draw a minimal DFA equivalent to the following three state NFA.



Show your work. Add extra pages if needed.

6. The following True/False questions are much harder. I have not given the answers in class, and you may have to really hunt to find them on the internet.

   (i) _____ DFA equivalence is $\mathcal{P}$–TIME.

   (ii) _____ NFA equivalence is $\mathcal{P}$–TIME.

   (iii) _____ NFA equivalence is $\mathcal{NP}$–TIME.

   (iv) _____ Regular expression equivalence is $\mathcal{NP}$–TIME.

   (v) _____ Regular expression equivalence is $\mathcal{P}$–SPACE.