University of Nevada, Las Vegas Computer Science 456/656 Fall 2023

Answers to Assignment 2: Due September 8, 2023

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

(a) $a^* + b^*$ Ans: $M_7$
(b) $\lambda$ Ans: $M_2$
(c) $a^*$ Ans: $M_3$
(d) $\emptyset$ Ans: $M_1$
(e) $a(aa + b)^*$ Ans: $M_8$
(f) $a^*b^*$ Ans: $M_6$
(g) $(a + b)^*$ Ans: $M_4$
(h) $(ab)^*$ Ans: $M_5$

2. True or False.

(a) T If $L$ is any language, $L + L = L$
(b) T If $L$ is any language, $L \cap L = L$
(c) T 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 \( L_1L_2 \)? Ans: Three.
\( L_1L_2 = \{aa, aba, abba\} \)

4. True or False. These are harder.

(a) T Any language consisting of all decimal numerals of an arithmetic sequence (for example: \( \{5, 13, 21, 29, \ldots\} \)) is regular.

(b) T Let \( L \) be a regular binary language. Let \( L' \) be the language of all strings obtained from members of \( L \) by substituting \( ab \) for 0 and \( c \) for 1. Then \( L' \) must be regular. For example, if \( L = \{0, 10, 10011\} \) 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 DFA equivalent to the following three state NFA. It is not necessary to draw the dead state.