University of Nevada, Las Vegas Computer Science 456/656 Spring 2025

Answers to Assignment 3: Due Saturday February 8, 2025

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

   (a) $a^* + b^*$ M_7

   (b) λ M_2

   (c) a^* M_3

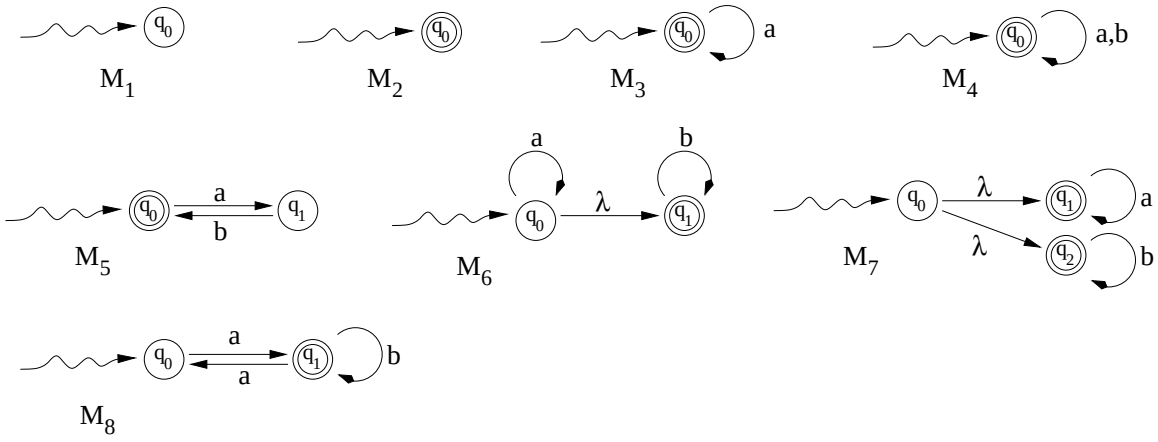
   (d) $\emptyset$ M_1

   (e) $a(aa + b)^*$ M_8

   (f) a^*b^* M_6

   (g) $(a + b)^*$ M_4

   (h) $(ab)^*$ M_5



2. True or False. If the answwer is unknown to science at this time, write **O** for Open.

   (a) **T** If L is any language, $L + L = L$

   (b) **T** If L is any language, $L \cap L = L$

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

   (d) **T** If L is any language, $L + L = L$

   (e) **T** If L is any language, $L \cap L = L$

   (g) **T** Any language consisting of all decimal numerals of an arithmetic sequence is regular.

   (h) **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 $L' = \{ab, cab, cababcc\}$.

   (i) **O** $\mathcal{P}$-TIME $= \mathcal{NP}$.

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

   3

   $L_1L_2 = \{aa, aba, abba\}$

4. The following program decides whether a given integer n is prime.

```
Read n
  For all i from 2 to n-1
    If(n%i = 0) return False.
Return True.
```

At first glance you would say it is a polynomial time algorithm. But it isn't. In fact, it takes exponential time. Explain.

Answer will be posted later.

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. The empty set is a dead state. You are not required to include it in the figure.