ToC Question Bank – 3

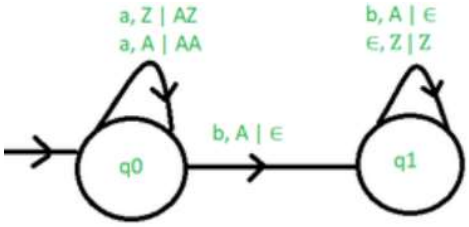
1. Construct DPDA for
   a. $L = \{a^n b^n \mid n > 0\}$
   b. $L = \{wcw^r \mid w \in \{a, b\}^*\}$
   c. $L = \{n_a(w) = n_b(w) \mid w \in \{a, b\}^*\}$
   d. $L = \{a^n b^n c^m \mid n > 0, m > 0\}$
   e. $L = \{a^{n+m} b^n c^m \mid n > 0, m > 0\}$
   f. $L = \{a^n bmc^{m+n} \mid n > 0, m > 0\}$
   g. $L = \{a^n b^{2n} \mid n > 0\}$
   h. $L = \{a^{2n} b^{3n} \mid n > 0\}$
2. Construct PDA for the following languages. Check whether each one is a DPDA.
   a. $L=\{a^n b^n \mid n \geq 1\} \cup \{a^n b^{2n} \mid n \geq 1\}$
   b. $\{ww^R \mid w=\{a, b\}^*\}$
   c. $L = \{n_a(w) > n_b(w) \mid w \in \{a, b\}^*\}$
   d. $L \{ w \in \{0, 1\}* \mid w = w^R$ and the length of w is odd $\}$
   e. $L \{ w \in \{0, 1\}* \mid w = w^R$ and the length of w is any $\}$
3. Consider the following CFG G = (V, Σ, R, S), where V = {S, T, X}, Σ = {a, b}, the start variable is S, and the rules R are

   $S \rightarrow aT\ Xb$

   $T \rightarrow XT\ S \mid \varepsilon$

   $X \rightarrow a \mid b$

   Convert G to an equivalent PDA
4. Convert PDA to CFG



5. Design Turing Machine to recognize
   a. $L = \{ 0^{2^n} \mid n \geq 0 \}$.
   b. $L = \{0^n 1^n 2^n\}$ where n≥1
   c. All strings over {0, 1} in which the number "01" pairs is odd.
   d. $q_0 w \vdash q_f w w^R$
   e. To check the palindrome of the string of any length.
   f. To add 2 unary numbers separated by a 0.
   g. To get the function c = f(a-b) where and b are two unary numbers separated by a 0 and a is always greater than b.
   h. $L = \{0^i 1^j 2^k\}$ where i x j = k, I, j, k ≥ 1
   i. Given a list of strings over {0, 1} separated by #, determine if all strings are different.
   j. ww ⊢ w#w, where w {1}*
   k. w ⊢ w^R where w {1}*

l. w ⊢ w mod 2 where w {1}*
m. L = {(a + b)∗b(a + b)∗}.
n. L = {w#w′ : w ∈ {a, b}∗ and w is a substring of w′}.
o. To accept a string with 'aba' as its substring
p. L = { $b^n a^n b^n$ | n ≥ 0 }.
q. w ∈ {a, b, c}∗|$n_a(w) = n_b(w)$ and $n_a(w) > n_c(w)$}
r. that changes all the a's on its tape to b's and vice versa
s. that doubles each character in its input string. For example, if the input is 0100, then the machine should change its tape so it contains 00110000

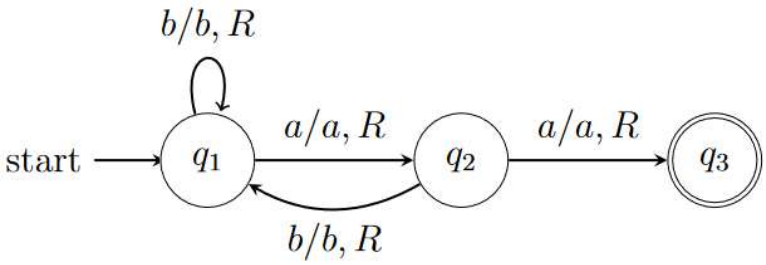
6. Consider the TM M = (Q, Σ, Γ, δ, q_0, q_f) where Q ={q_0, q_1, q_f}, Σ = {0, 1}, Γ = {0, 1, B}, and δ is given by:

   δ(q_0, 0) = (q_0, 0, R), δ(q_0, 1) = (q_0, 1, R), δ(q_0, B) = (q_1, B, L), δ(q_1, 0) = (q_f, 1, R),

   δ(q_1, 1) = (q_1, 0, L), δ(q_1, B) = (q_f, B, L)

   What is the function computed by M?

7. What is the regular expression accepted by the below TM?



8. L = {wcw where w∈{a,b}} using 2 tape Turing Machine.