Theory of Automata – Homework 6

Name – Akshay Kumar Singh

R11603620

1. Consider the pushdown automata $M = (K, \Sigma, \Gamma, \Delta, s, F)$, where
   $K = \{s, f\}$,
   $F = \{f\}$,
   $\Sigma = \{a, b\}$,
   $\Gamma = \{a\}$,
   $\Delta = \{((s, a, e), (s, a)), ((s, b, e), (s, a)), ((s, a, e), (f, e)),$
   $((f, a, a), (f, e)), ((f, b, a), (f, e))\}$.

   a). Trace all possible sequence of transitions of M on input aba

   b). Show that $aba, aa, abb \notin L(M)$, but $baa, bab, baaaa \in L(M)$

   c). Describe $L(M)$ in English

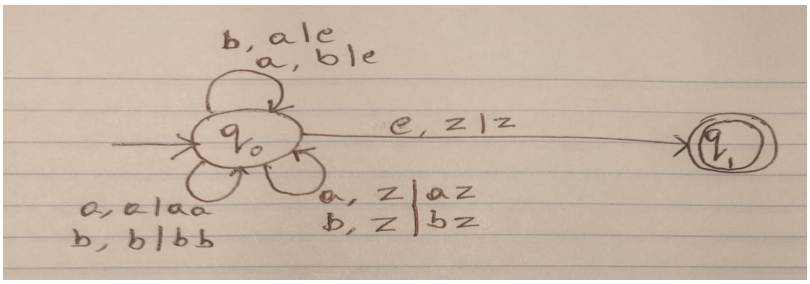
Sol : **a)** There are three possible computations of M on aba:
(s, aba, e) |- (s, ba, a) |- (s, a, aa) |- (s, e, aaa)
(s, aba, e) |- (s, ba, a) |- (s, a, aa) |- (f, e, aa)
(s, aba, e) |- (f, ba, e)
None of these is an accepting configuration.

(b) This is done by tracing the computation of M on each of the strings, as shown in (a).

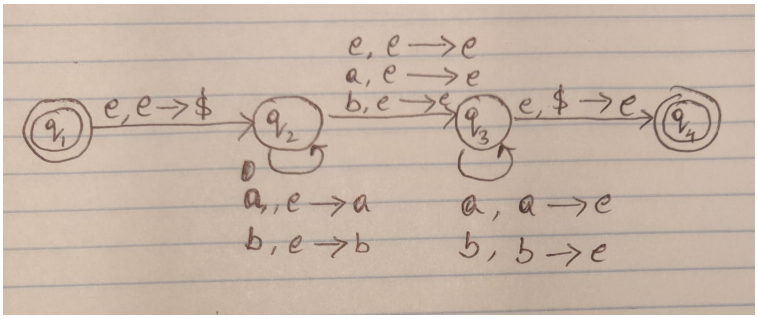
(c) L(M) is the set of strings whose middle symbol is a. In other words, L(M) = {xay ∈ {a, b}* : |x| = |y|}.

2. Construct a Pushdown automata that accept each of the followings:
   a). The language $\{w \in \{a, b\}^* : w = w^R\}$
   b). The language $\{w \in \{a, b\}^* : w$ has the same number of $a's$ and $b's\}$

   Sol : **a)**
   Z is the 'start stack symbol'


b, a | e
a, b | e
e, z | z
a, a | aa
b, b | bb
a, z | az
b, z | bz

b)


e, e → e
a, e → e
b, e → e
e, e → $
e, $ → e
a, e → a
b, e → b
a, a → e
b, b → e