The University of Melbourne
School of Computing and Information Systems
COMP30026 Models of Computation

Assignment 2, 2018

Samuel Xu
Student No. 835273

Challenge 5 Answer

Let $DFA(Q, \Sigma, \delta, q_0, F)$ and $PDA(Q', \Sigma', \Gamma, \delta', q'_0, F')$

The goal is to translate our DFA to a 3-state PDA. This can be accomplished by creating a PDA similar to that of a naive search or graph traversal.
This process is possible as there are only two cases to account for:

a. The current state is *not* an accept state

b. The current state is an accept state

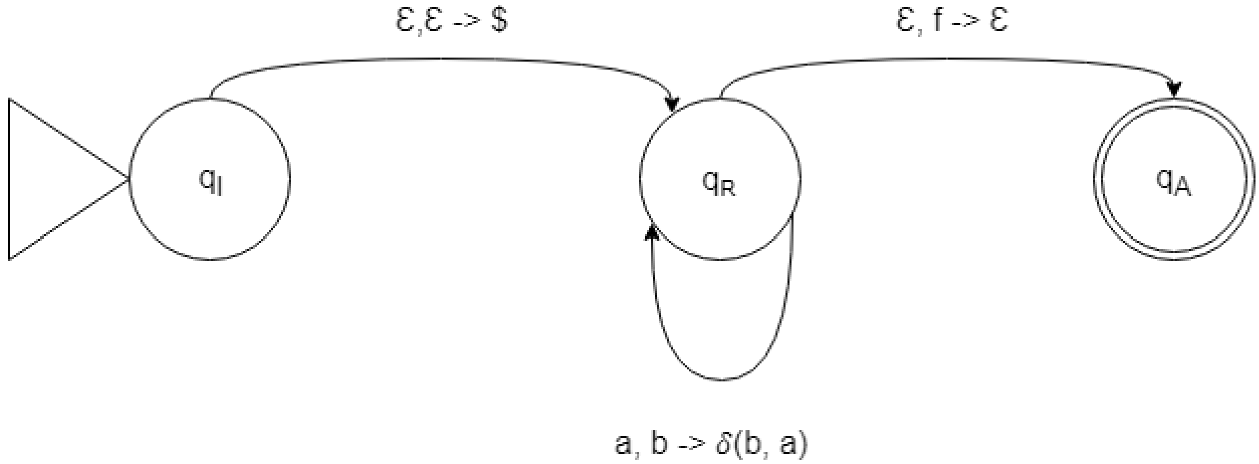
This results in a translation from any DFA to a 3-state PDA; the first state of the PDA being the *initialisation state* (q_I), followed by the *searching state* (q_R) and the *accept state* (q_A).

First we start by defining our variables:

DFA:
Let Q be a set of DFA states.
Let Σ be a valid alphabet for our DFA.
Let δ be a valid set of transition functions for moving between states with a given input.
Let q_0 be the initial state of our DFA.
Let F be a set of valid accept states for our DFA.

PDA:
Let $Q' = \{q_I, q_R, q_A\}$
Let $\Sigma' = \Sigma_\epsilon$
Let Γ be a stack alphabet where $\Gamma = Q$
Let δ' be the three transition functions between q_I, q_R, and q_A
(following the form described in lecture 18 $\delta : Q \times \Sigma_\epsilon \times \Gamma_\epsilon \to \mathcal{P}(Q \times \Gamma_\epsilon)$;
$\delta : \{(q_I, \epsilon, \epsilon, \to q_R, q_0), (q_R, a, b, \to q_R, \delta(b, a)), (q_R, \epsilon, f \to q_A, \epsilon)\}$
Let q'_0 be the starting state $\{q_I\}$
Let F' be the accept state $\{q_A\}$
Let a be a string input where $a \in \Sigma$
Let b be a state where $b \in Q$
Let f be an accept state where $f \in F$

Now we may draw a PDA:


Ɛ,Ɛ -> $
Ɛ, f -> Ɛ
q_I
q_R
q_A
a, b -> δ(b, a)