

Assignment 7, due 3/12/2020 in class

1. Consider the pushdown automaton $M = (Q, \Sigma, \Gamma, \delta, q_1, F)$ where

$$\begin{aligned} Q &= \{q_1, q_2, q_3\} \\ \Sigma &= \{a, b\} \\ \Gamma &= \{c, d\} \\ F &= \{q_1, q_3\} \end{aligned}$$

and δ is given by the following:

$$\begin{aligned} \delta(q_1, a, \varepsilon) &= \{(q_2, c)\} \\ \delta(q_1, b, \varepsilon) &= \{(q_3, d)\} \\ \delta(q_2, b, \varepsilon) &= \{(q_2, d)\} \\ \delta(q_2, a, d) &= \{(q_3, \varepsilon)\} \\ \delta(q_3, a, c) &= \{(q_3, \varepsilon)\} \\ \delta(q_3, a, d) &= \{(q_3, \varepsilon)\} \\ \delta(q_3, b, d) &= \{(q_3, \varepsilon)\}. \end{aligned}$$

- (a) Draw a diagram for this PDA.
- (b) For each of the following strings, say if it is accepted or rejected by the PDA: $\varepsilon, a, b, aa, ab, aba, abaa, abba, abbaba, abbabb$.
- (c) Describe the language accepted by this PDA.
2. Build a pushdown automaton (either deterministic or nondeterministic) that accepts the language of all valid parenthesised expressions with symbols $\{a, (,)\}$. The following are valid expressions:

$$a, (a), aa, (a)(a), (((a))), ((a))a$$

The following are invalid expressions:

$$\varepsilon, (), (a), ((a), (a)(), (()a)$$