Indian Institute of Technology Dharwad

CS 202: Assignment 2

Release date: 18 February 2022
Submission Deadline : 2200 hours, 25 February 2022.

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1. Let G be the grammar given as follows:

   $S \to aB \mid bA$
   $A \to a \mid aS \mid bAA$
   $B \to b \mid bS \mid aBB$

   (a) For the string *aaabbabbba* find:
      i. a leftmost derivation
      ii. a rightmost derivation
      iii. a parse tree
   (b) Is the grammar given above unambiguous? Justify.

2. Write context-free grammar for the following languages:

   (a) $\{w \in \{0,1\}^* \mid w \text{ contains at least three } 1's\}$
   (b) $\{w \in \{0,1\}^* \mid$ length of w is odd and middle symbol is $0\}$
   (c) $\{a^i b^j c^k \mid i,j,k \geq 0,\ i+j=k\}$

3. Construct a PDA equivalent to the following grammar:

   $S \to aAA$
   $A \to aS \mid bS \mid a$

4. Give a context-free grammar for generating regular expressions defined over alphabet $\Sigma = \{a, b\}$.

   Optional:Can you write a program to translate regular expression to finite automaton. Firstly, you need to generate a CFG for regular expressions, write a parser and finally the automaton-generating routines.

5. Show that if all productions of a CFG G are of the form $A \to wB$ or $A \to w$, then $L(G)$ is a regular set.

6. Construct a CFG equivalent to the NPDA shown in Figure.1, using the algorithm done in the class.

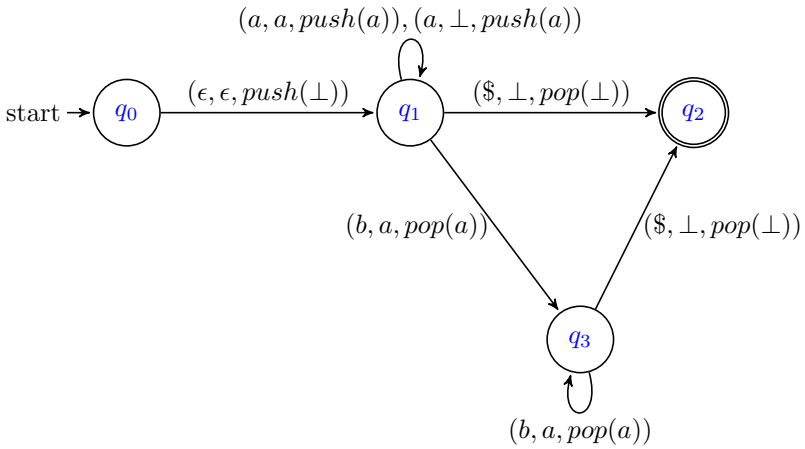

Figure 1: NPDA