

## TOC Question Bank 6

### 1. Do the following

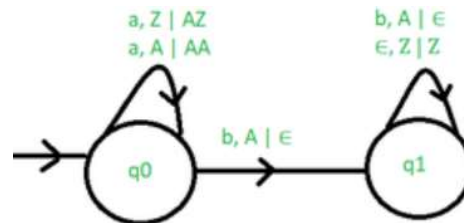
- i. State whether the language follows prefix property.
- ii. Construct PDA to accept by final state
- iii. Check whether you can construct a PDA to accept by empty stack
- iv. State whether the PDA is nPDA or dPDA
  - i.  $L = \{0^n 1^m 2^m 3^n \mid n \geq 1, m \geq 1\}$
  - ii.  $L = \{a^n b^{2n} \mid n \geq 1\}$
  - iii.  $L = \{0^n 1^m \mid n \geq 1, m \geq 1, m > n+2\}$
  - iv.  $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i = j \text{ or } i = k\}$
  - v. Accepting the language of balanced parentheses. (Consider any type of parentheses)
  - vi.  $L = \{a^i b^{i+j} c^j \mid i \geq 0, j \geq 1\}$
  - vii.  $L = \{a^n b^n \mid n > 0\}$
  - viii.  $L = \{w c w^r \mid w \in \{a, b\}^*\}$
  - ix.  $L = \{n_a(w) = n_b(w) \mid w \in \{a, b\}^*\}$
  - x.  $L = \{a^n b^n c^m \mid n > 0, m > 0\}$
  - xi.  $L = \{a^{n+m} b^n c^m \mid n > 0, m > 0\}$
  - xii.  $L = \{a^n b^m c^{m+n} \mid n > 0, m > 0\}$
  - xiii.  $L = \{a^{2n} b^{3n} \mid n > 0\}$
  - xiv.  $L = \{a^n b^n \mid n \geq 1\} \cup \{a^n b^{2n} \mid n \geq 1\}$
  - xv.  $\{w w^R \mid w \in \{a, b\}^*\}$
  - xvi.  $L = \{n_a(w) > n_b(w) \mid w \in \{a, b\}^*\}$
  - xvii.  $L = \{w \in \{0, 1\}^* \mid w = w^R \text{ and the length of } w \text{ is odd}\}$
  - xviii.  $L = \{w \in \{0, 1\}^* \mid w = w^R \text{ and the length of } w \text{ is any}\}$
  - xix.  $A = \{w \in \{0, 1\}^* \mid w \text{ contains at least three 1s}\}$ .

### 2. Convert CFG to an equivalent PDA. Consider a string belonging to the CFL and derive its LMD from CFG and configurations from PDA to accept the same

- i.  $S \rightarrow aT Xb, T \rightarrow XT S \mid \epsilon, X \rightarrow a \mid b$
- ii.  $S \rightarrow 0S1 \mid A, A \rightarrow 1A0 \mid S \mid \epsilon$
- iii.  $S \rightarrow 0SX \mid 1SY \mid \epsilon, X \rightarrow 1, Y \rightarrow 0$
- iv.  $S \rightarrow 0S1S \mid 1S0S \mid \epsilon$
- v.  $S \rightarrow XS \mid \epsilon, A \rightarrow aXb \mid Ab \mid ab$
- vi.  $S \rightarrow XY, X \rightarrow aX \mid \epsilon, Y \rightarrow bY c \mid \epsilon$
- vii.  $S \rightarrow aABC, A \rightarrow aB \mid a, B \rightarrow bA \mid b, C \rightarrow a$
- viii.  $S \rightarrow aT Xb, T \rightarrow XT S \mid \epsilon, X \rightarrow a \mid b$

### 3. Convert PDA to CFG

i.



- ii.  $M = (\{q_0, q_1\}, \{0, 1\}, \{X, Z_0\}, D, q_0, Z_0, \{\})$  with
 
$$\delta(q_0, 0, Z_0) = (q_0, XZ_0)$$

$$\delta(q_0, 0, X) = (q_0, XX)$$

$$\delta(q_0, 1, X) = (q_1, \varepsilon)$$

$$\delta(q_1, 1, X) = (q_1, \varepsilon)$$

$$\delta(q_1, \varepsilon, X) = (q_1, \varepsilon)$$

$$\delta(q_1, e, Z_0) = (q_1, \varepsilon)$$

iii.  $M = (\{p, q, r\}, \{(, )\}, \{(, Z_0), \delta, p, Z, \{\})\})$  with

$$\delta(p, (, Z) = \{(q, (Z)\}$$

$$\delta(q, (, () = \{(q, (())\}$$

$$\delta(q, ), () = \{(q, \varepsilon)\}$$

$$\delta(p, \varepsilon, Z) = \{(r, \varepsilon)\}$$

$$\delta(q, \varepsilon, Z) = \{(r, \varepsilon)\}$$