

# Theory of Automata

## Assignment CFL

Due Date: Tuesday 20th November 2023 before Class

### Problem 1:

a) Let G be the grammar:

$$\begin{aligned} S &\rightarrow abSc \mid A \\ A &\rightarrow cAd \mid cd \end{aligned}$$

i) Give a derivation of ababccddcc

ii) Build the parse tree for i)

iii) Convert this Grammar to CNF and prove the above string (1<sup>st</sup> 5 Length word) using CYK parser.

b) Let G be the grammar:

$$\begin{aligned} S &\rightarrow ASB \mid null \\ A &\rightarrow ASB \mid null \\ B &\rightarrow bBa \mid ba \end{aligned}$$

iv) Give a left most derivation of abaabbbabbaa

v) Build the parse tree for iii)

vi) Convert this Grammar to CNF and prove the above string (1<sup>st</sup> 5 Length word) using CYK parser.

## Problem 2:

Give CFG & Design PDA that generate & accepts the following languages:

- $L = \{w \mid w \text{ contains at least three } 1's\}$   $\Sigma = \{0,1\}$
- $L = \{w \mid \text{the length of } w \text{ is odd \& its middle symbol is } 0\}$   $\Sigma = \{0,1\}$
- $L = \{w \mid w \text{ contains more } 0's \text{ than } 1's\}$   $\Sigma = \{0,1\}$
- $L = \{0^i 1^j \mid i \leq j\}$
- $L = \{0^i 1^j \mid i < 2j\}$
- $L = \{0^i 1^j \mid j = 2i\}$
- $L = \{a^i b^j c^k \mid i, j, k \geq 0 \& i = j \text{ or } j = k\}$
- $L = \{a^i b^j c^k \mid i, j, k \geq 0 \& i + j = k\}$
- $L = \{a^i b^j c^k \mid i, j, k \geq 0 \& i + k = j\}$
- $L$  is non palindrome language over  $\{a, b\}$
- $L = \{w : w \text{ has twice as many } a's \text{ as } b's\}$
- $L = \{a^i b^j : i = 3j + 2\}$
- $L = \{a^{2i} b^{3j} : i, j \geq 0\}$
- $L = \{w \mid \text{length of } w \text{ is odd}\}$
- $L = \{w \mid \text{length of } w \text{ is divisible by } 3\}$
- $L = \{(ab)^m c^n d^n (c)^m \mid m, n > 0\}$
- $L = \{(a^i b^i)^m (b^j a^j)^m \mid i \geq 0, j > 0, m \geq 0\}$
- $L = \{a^n b^n c^m \mid n, m \geq 2\}$
- $L = \{a^n b^m c^n \mid n, m \geq 2\}$
- $L = \{a^n b^m \mid n + m = \text{even}\}$
- $L = \{a^n b^m \mid n + m = \text{odd}\}$