

# Assignment 3

## Overview

This assignment satisfies the following learning objectives of the course:

- Construct Context Free Grammar
- Convert to normal form
- Ambiguity

## Rules and Deliverables

- This is an individual assignment.
- The assignment is due on **Wednesday 10/16/24 at 11:59 pm**
- Submitting the assignment 24 hours after the due date will result in a deduction of 20% from the student's grade.
- Each student should submit the answer in PDF format on Canvas.
- Students are responsible for submitting all the files before the due date. Please check the submitting files to make sure all the answers are submitted.

## Assignment Description

1. Find grammar for the following languages:

- $L = \{a^n b^m c^k \mid n = k + m \text{ and } n \geq 0, m \geq 0, k \geq 0\}$  (3 points)
- $L = \{(ab)^n (cd)^n : n \geq 1\}$  (3 points)
- Language whose 3<sup>rd</sup> symbol from last is b. over  $\{a, b\}$  (3 point)

2. What is the language of the following CFG? (5 points)

$$\left\{ \begin{array}{l} S \rightarrow AB \mid \varepsilon \\ A \rightarrow 1A \mid S \\ B \rightarrow 0B \mid S \end{array} \right.$$

3. Remove the  $\varepsilon$ -Productions: (3 points)

$$\left\{ \begin{array}{l} S \rightarrow AaB \mid aaB \\ A \rightarrow \varepsilon \\ B \rightarrow aaA \mid \varepsilon \end{array} \right.$$

4. Convert the following CFG into an equivalent CFG in Chomsky Normal Form: (3 points)

$$\begin{cases} A \rightarrow BAB \mid B \mid \varepsilon \\ B \rightarrow 00 \mid \varepsilon \end{cases}$$

5. i) Find the grammar for the following language. (5 points)

$$L = \{ a^n b^n c^m d^m \mid n \geq 1, m \geq 1 \} \cup \{ a^n b^m c^m d^n \mid n \geq 1, m \geq 1 \}$$

- ii) Convert the generated Context Free Grammar to Greibach Normal Form. (3 points)

- iii) Is the grammar for language L ambiguous? Why? (2 points)