UNIVERSITY OF CENTRAL PUNJAB

SPRING 2025

Course Title: Theory of Automata
Course Code: CSAL3253-S25-BS-CS-F22-F7

Assignment No. 03

Course Instructor: Ms. Zar Bakht Imtiaz		
Section: F7	Program: BSCS	Date: 14/06/2025
Submission Date: 21/06/2025	Maximum Marks: 70	
Program Objective:	Course Objective: CO3	Course Learning Objective: CLO3
TO BE FILLED IN BY THE STUDENT		
Student Name:	Registration No:	Sr. No:

Instructions:

1. No submission after deadline.
2. Assignment must be submitted individually.
3. You will get Zero marks if found any type of cheating.
4. Understanding of the problems is part of the assignments. Answer all questions clearly and concisely.
5. Upload the solved assignment (soft copy) at university portal before the deadline

Assignment Topic & Details:

Context Free Grammar, Ambiguous, Chomsky Normal Form

Q1. Design a CFG for this robot movement language and also parse tree through left most derivation the string LRLR:
*L = { w ∈{L, R} | L's and R's alternate starting with L }**

Valid: `L`, `LR`, `LRLR`, `LRLRLR`
Invalid: `RR`, `LL`, `RL`

Q2. Construct a CFG and parse tree (right most derivation) the string `0 1 1 0`:

L_6 = {w ∈ {0,1} | w contains an equal number of 0's and 1's} *

Q3. Dialogue Bot Phrases

A bot speaks in a pattern like:

Hi, Hi Hello, Hi Hello Hi, Hi Hello Hi Hello, etc.

Where it always starts with "Hi" and alternates between "Hi" and "Hello".

Create a CFG for valid bot phrases and derive the string `Hi Hello Hi Hello` through left most derivation.

Q4. Ambiguity Detection

Given the CFG:

S → aSbS | bSaS | ε

Is the grammar ambiguous? Justify.

Q5.

Given:

S → 0S0 | 1S1 | ε

a) What language is this grammar generating?
b) Prove or disprove its ambiguity.

Q6.

Convert to CNF:
S → aA | B
A → a | b
B → bB | b

Q7.

Convert to CNF:
S → aAB | bBA
A → a | ε
B → b