


# National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Theory of Automata	Course Code:	
	Degree Program:	BS(CS)	Semester:	Fall 2025
	Section:	3A,3B,5F	Marks:	30
	Assignment	2	Deadline	29 <sup>th</sup> Nov 2025

**Q1: Generate CFG for the following:**

**(2\*6)**

- a)  $L = \{a^n b^m c^m d^n; n, m \geq 2\}$
- b)  $\{x \in \{0, 1\}^* \mid \text{the length of } w \text{ is odd and the middle symbol is } 1\}$
- c)  $\{a^i b^j c^k \mid i, j, k \geq 0, \text{ and } i = j \text{ or } i = k\}$
- d)  $L = \{0^i 1^j 0^k \mid j > i + k; i, j, k \geq 0\}$
- e)  $L = \{a^i b^j c^k; i \leq 2j; i \geq 0; k \geq 0\}$
- f)  $\{i^a j^b k^c \mid a, b, c \geq 0 \text{ and } a + b = c\}$

**Q2: Convert the following CFG to CNF:**

**(4\*3)**

- a)  $S \rightarrow T U \mid V$   
 $T \rightarrow a T b \mid \epsilon$   
 $U \rightarrow c U \mid \epsilon$   
 $V \rightarrow a V c \mid W$   
 $W \rightarrow b W \mid \epsilon$
- b)  $S \rightarrow A S B$   
 $A \rightarrow a A S \mid a \mid \epsilon$   
 $B \rightarrow S b S \mid A \mid b b$
- c)  $S \rightarrow B S B \mid B \mid \epsilon$   
 $B \rightarrow 1 1 \mid \epsilon$

**Q3: Use CYK Parser to check if the following strings belong to the following CNFs:**  
**(2\*3)**

- a)  $w = \text{baaba on}$   
 $S \rightarrow A B \mid B C$   
 $A \rightarrow B A \mid a$   
 $B \rightarrow C C \mid b$   
 $C \rightarrow A B \mid a$

**b)**  $w = \text{abbaba}$  on the CNF obtained in Q2 b)

**c)**  $w = \text{ababb}$  on

$S \rightarrow AB \mid BC$

$A \rightarrow BB \mid a$

$B \rightarrow BA \mid b$

$C \rightarrow AC \mid AA \mid a$