

National University of Computer and Emerging Sciences, Lahore Campus



Course Name: Theory of Automata
Degree Program: BS (CS)
Exam Duration: 60 Minutes
Paper Date: 11-11-2023
Section: ALL
Exam Type: Midterm-II

Course Code: CS-3005
Semester: Fall 2023
Total Marks: 30
Weight: 17.5%
Page(s): 6

Student : Name: _____ Roll No. _____ Section: _____

Instruction/Notes: Answer in the space provided, showing complete working.
You can take **ROUGH SHEETS** but don't attach them with the question paper. Solve the paper with a pen. Paper solved with a pencil will not be marked.

In case of confusion or ambiguity make a reasonable assumption.

Good luck!

Question 1: (5 points):

Prove that the following language is not regular using pumping Lemma I

$$\Sigma = \{a, b\}$$

$$L = \{x \mid x \in \Sigma^* \text{ and } x = a^i b^j \text{ where } i \neq j \text{ and } 2i \neq j\}$$

$$x = a^{P+1} b^P$$

$$\begin{matrix} x = a^{P-s} \\ y = a^s \\ z = a b^P \end{matrix} \leftarrow \begin{matrix} P+1 \\ b^P \end{matrix}$$

So, taking

$$s = 1 \text{ and } i = 0$$

$$a^{P-1} (a^1)^0 a b^P$$

$$= a^{P-1} a b^P = a^P b^P \notin L$$

So $L \notin RL$

Number: _____
Question 3 (10 points)

Section: _____

Apply CYK algorithm to tell whether the string $x=abcba$ is acceptable by the following grammar

$S \rightarrow AX \mid BY \mid B \mid c$ \rightarrow $S_0 \rightarrow AX \mid BY \mid b \mid c$
 $A \rightarrow a$
 $B \rightarrow b$
 $X \rightarrow SA \mid a$
 $Y \rightarrow SB \mid b$

You have to fill the table.

	5	4	3	2	1
1	S_0, S	—	—	—	A, X
2	X	S_0, S	—	S_0, S, B, Y	X
3	—	Y	S_0, S	X	X
4	X	S_0, S, B, Y	X	X	X
5	A, X	X	X	X	X

Note:
 Use only the required cells.