"Solution"

National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Theory of Automata	Course Code:	CS-3005
	Degree Program:	BS (CS)	Semester:	Fall 2023
	Exam Duration:	60 Minutes	Total Marks:	30
	Paper Date:	11-11-2023	Weight	17.5%
	Section:	ALL	Page(s):	6
	Exam Type:	Midterm-II		

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

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

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

$x = a^{p+1} b^p$ $\quad p > 1$

$u = a^{p-s}$

$v = a^s$

$w = a b^p$

$|s| \geq 1$ $\quad \forall i \geq 0$ $\quad uv^i w \in L$

So taking $s = 1$ & $i = 0$

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

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

$L \notin RL$

Roll Number:_____ Section: _____

Roll Number:_____ Section: _____

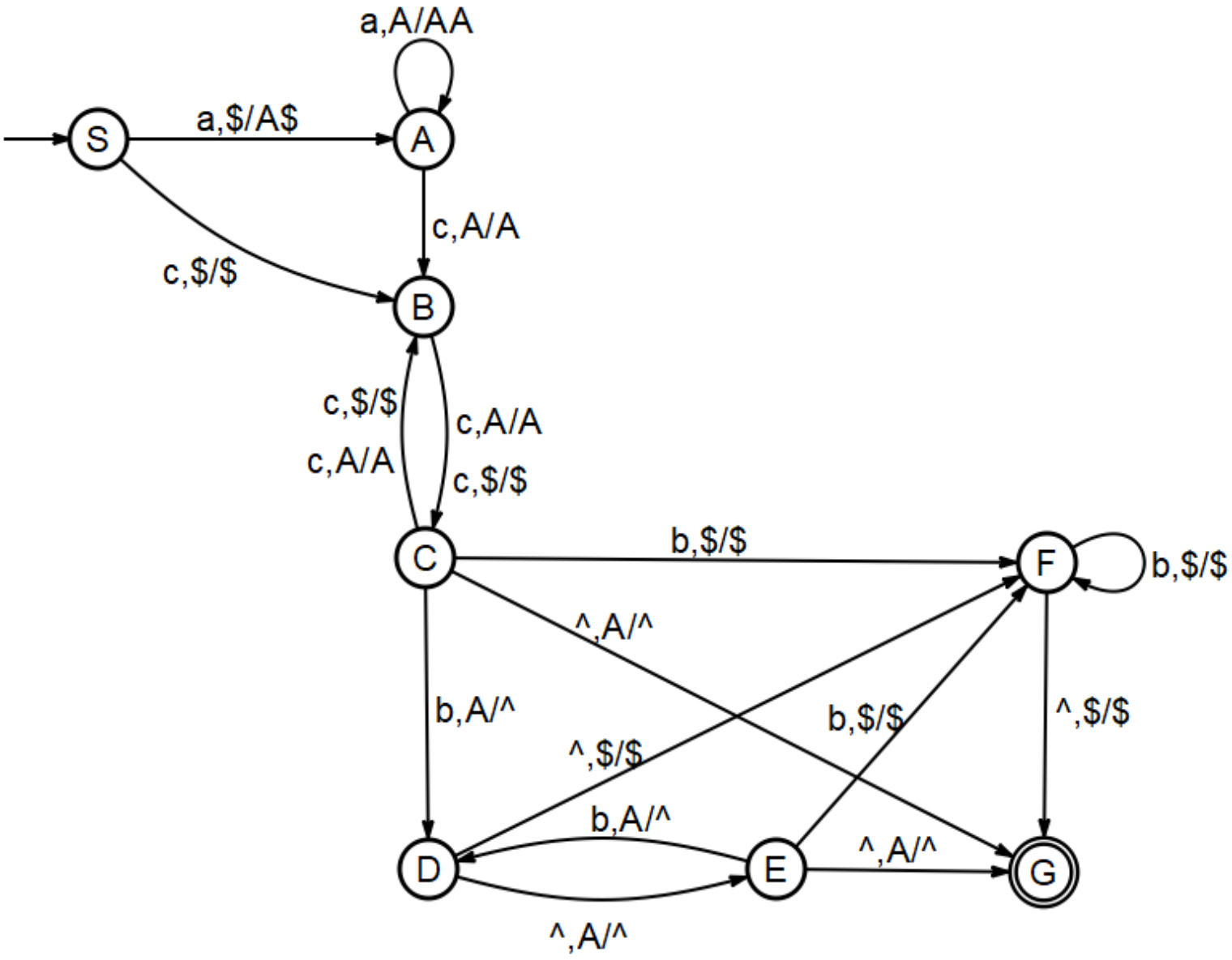
Question 2: (15 points):

Develop a PDA for the following language.

$$L= \{x \mid x \in \sum^* \text{ and } x=a^i c^k b^j \text{ where k is even and } k> 0 \text{ and } i \neq 2j\}$$

Note:

Please be neat in drawing PDA. No marks if it is not readable.



Roll Number:_____ Section: _____

Question 3 (10 points)

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

~~**S → AX | BY | B | c**~~ So -> AX | BY | b | c
A → a S -> AX | BY | b | c
B → b
X → SA | a
Y → SB | b

You have to fill the table.

As Start Variable belongs to j=5 cell so x belongs to L

j=5	S,So				
j=4	-	X			
j=3	-	S,So	-		
j=2	-	-	Y	X	
j=1	A,X	B,Y,S,So	S,So	B,Y,S,So	A,X
	a	b	c	b	a

Note:
Use only the required cells.

Roll Number:_____ Section: _____

Rough Work