National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Theory of Automata	Course Code:	CS-3005
	Degree Program:	BS (CS)	Semester:	Fall 2022
	Exam Duration:	60 Minutes	Total Marks:	25
	Paper Date:	28-9-2022	Weight	15%
	Section:	ALL	Page(s):	6
	Exam Type:	Midterm-I		

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

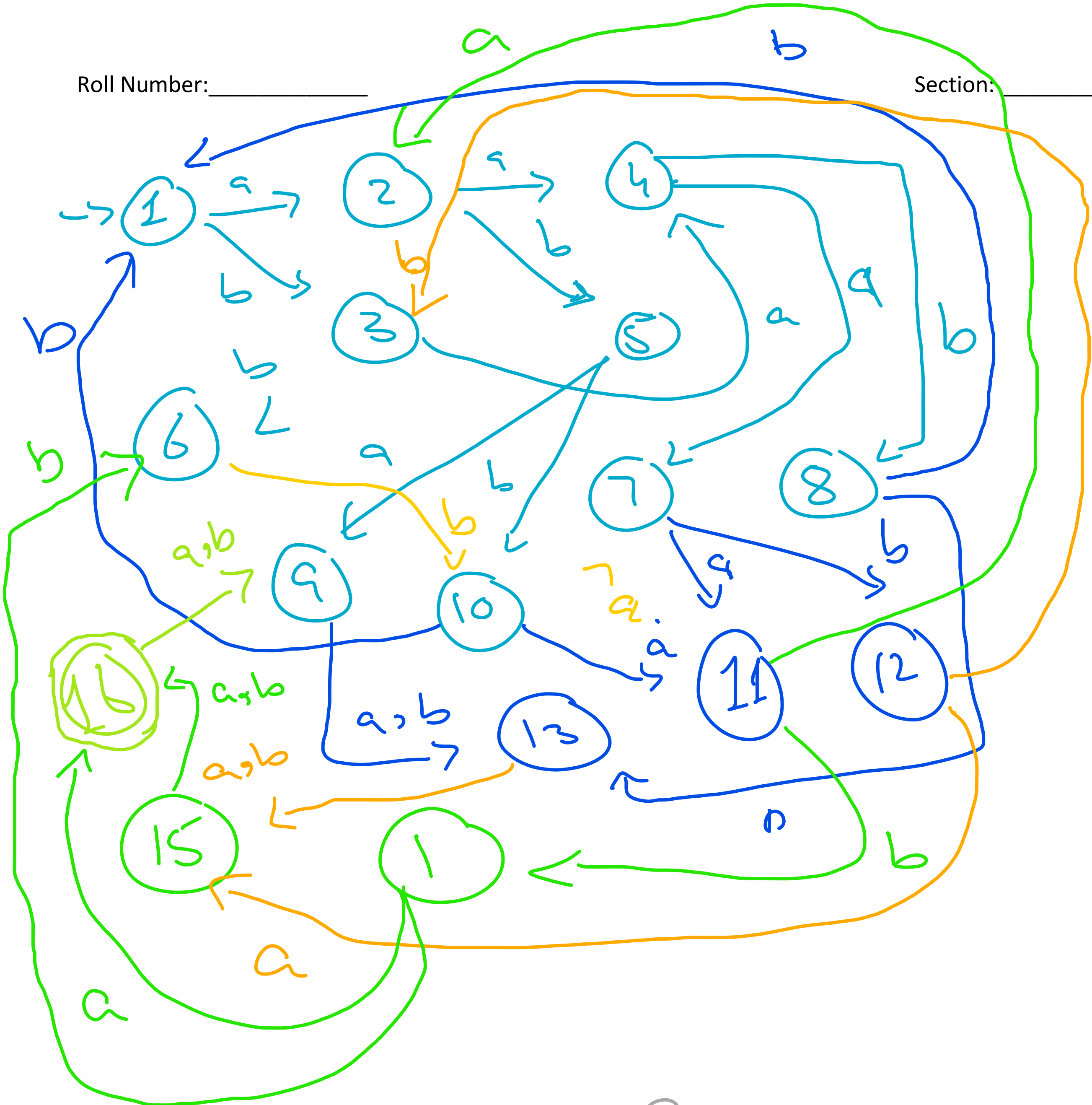
Instruction/Notes: Answer in the space provided, showing complete working.
ROUGH SHEETS ARE NOT ALLOWED.
In case of confusion or ambiguity make a reasonable assumption.

Good luck!

Question 1: (10 points):
Design deterministic finite automata of the following language:

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

$$L = \{x \mid x \in \sum^* \text{ and } |x| \text{ is divisible by 2 but not divisible by 4 and x has at least one occurrence of } \mathbf{aba}\}$$



$F_n = \{16\}$

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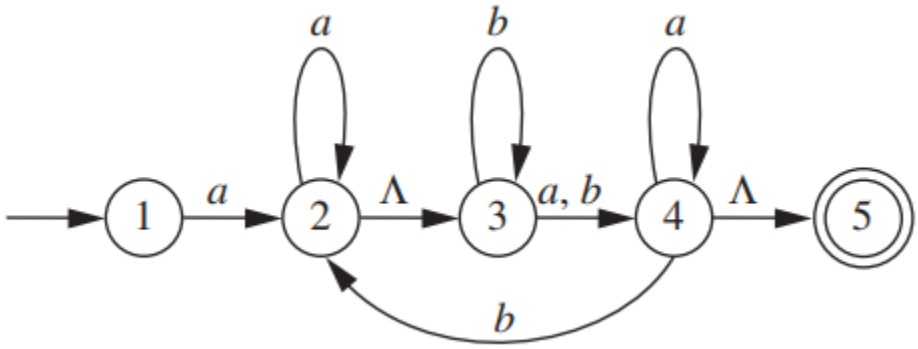
Question 2: (5 points):

Using the extended transition function for NFA-NULL, tell whether the string **ab** ∈ L or not. Show full working.



$\delta^*(1, \Lambda) = \Lambda\{1\} = \{1\}$

$\delta(1, a) = \Lambda\{\delta(1,)\}$

$= \Lambda\{2\}$

$= \{2, 3\}$

$\delta(1, ab) = \Lambda\{\delta(2,b) \cup \delta(3,b)\}$

$= \Lambda\{\phi \cup \{3,4\}\}$

$= \Lambda\{3,4\}$

$= \{3,4,5\}$

$\in f$

So $\boxed{ab \in L}$

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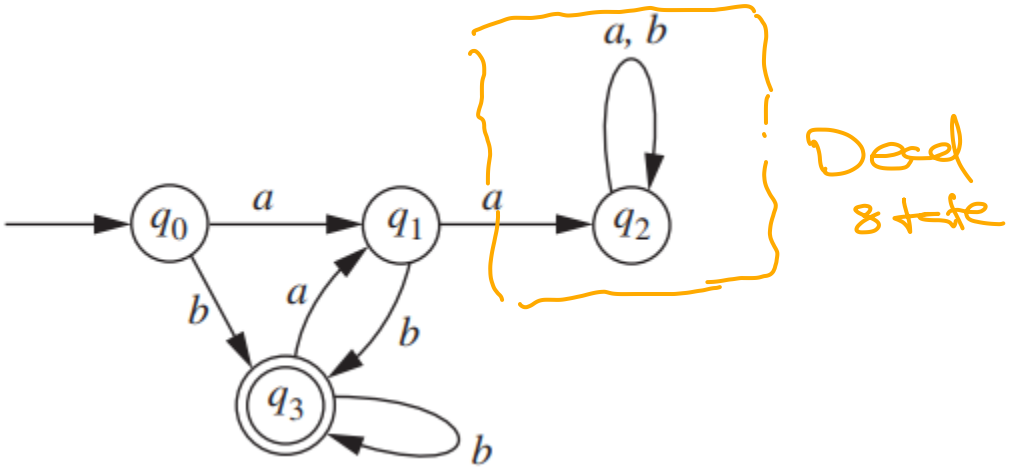
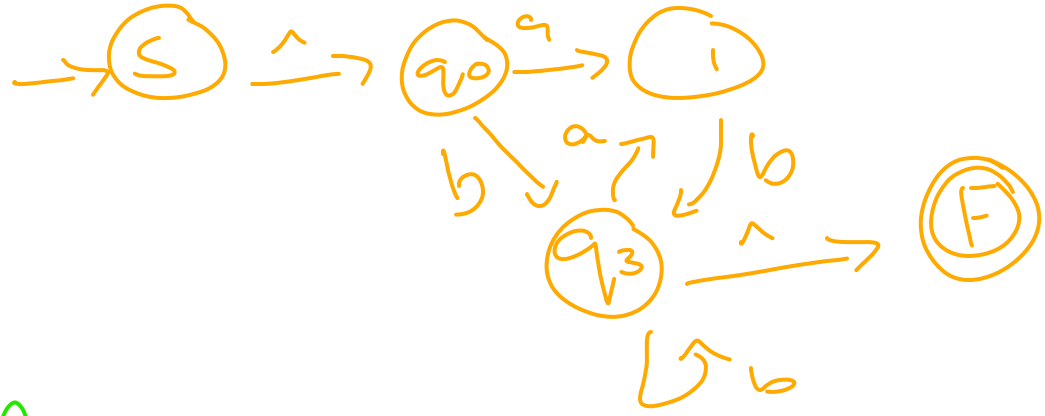
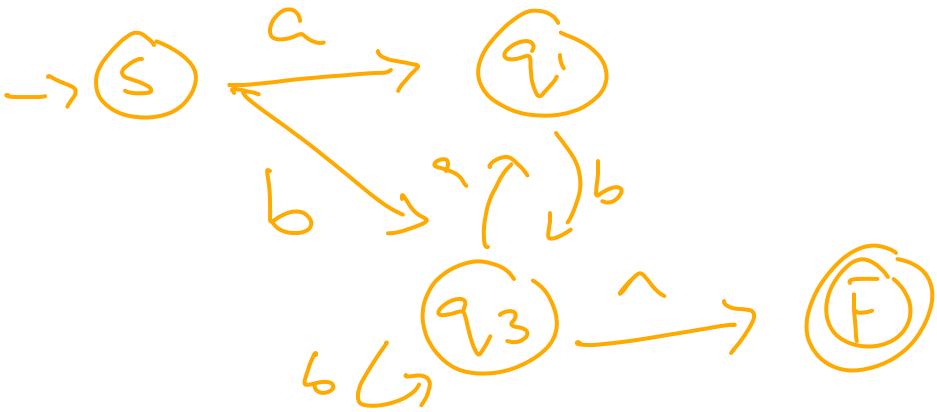
Question 3 (10 points): Extract the regular expression from the following DFA using the state elimination method. Delete states in increasing order [delete q_0, q_1, q_2, …. So on]





Rem 'q0' state



Now Removing 'q1'

Now removing 'q3'

$$RE = b + ab(ab+b)^*$$

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//for rough work