SRM Institute of Science and Technology
College of Engineering and Technology
SCHOOL OF COMPUTING
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu

Academic Year: 2023-24 (ODD SEMESTER)

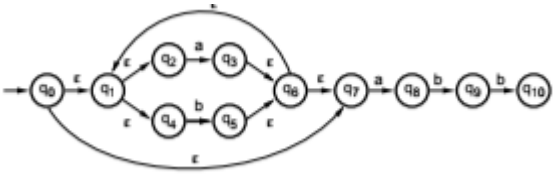
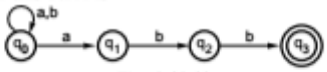
Mode of Exam
OFFLINE
(OPEN BOOK)
SET D

Test: CLAT-1 **Date:16-08-2023**
Course Code & Title: 18CSC301T - Formal Language and Automata **Duration: 50 minutes**
Year & Sem: III-Year & V-Semester **Max. Marks: 25**

Course articulation matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3														3
CO-2		3	2												3
CO-3		3	3												3
CO-4		3	3												3
CO-5			3	1									2		3

Part – A (13 x 1 = 13 Marks)

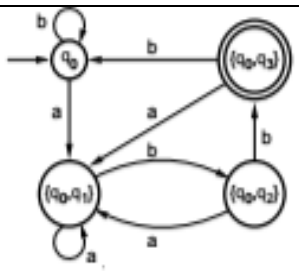
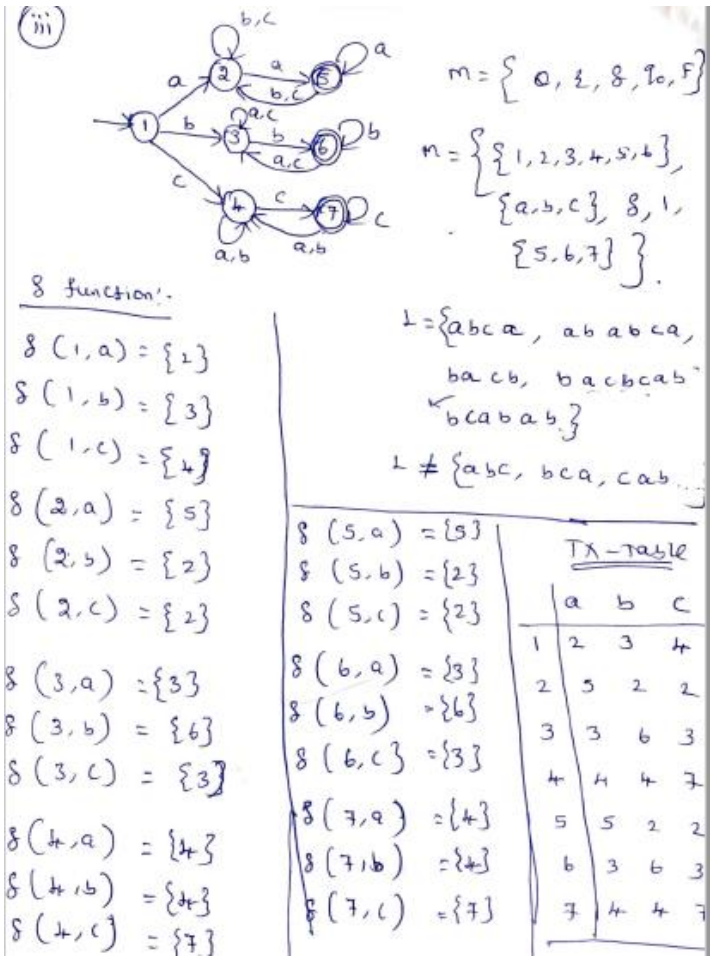
Q. No	Question	Marks	BL	CO	PO	PI Code
1	A pulmonary embolism is a blood clot that blocks and stops blood flow to an artery in the lung. When a blood clot in the deep veins in your leg breaks off and travels to your lungs are represented as 'a'. A blood clot that travels to another part of your body is called an embolus are represented as 'b'.			1	2	2.5.2
	i. Write a RE to identify people with who has 'a' clot or 'b' clot or any combination of clots followed by 'abb'. **ANSWER :** (a+b)* abb	1	L_1			
	ii. What are the input strings accepted by the R.E. **ANSWER :** {aabb,babb…}	1	L_1			
	iii. Design a Ɛ- NFA using Thompson's construction **(3 marks)** and convert the Ɛ- NFA to NFA **(3 marks)** **ANSWER :**	6	L_4			
	 The transition table for this NFA is  Fig. 2.16.10	5	L_5			

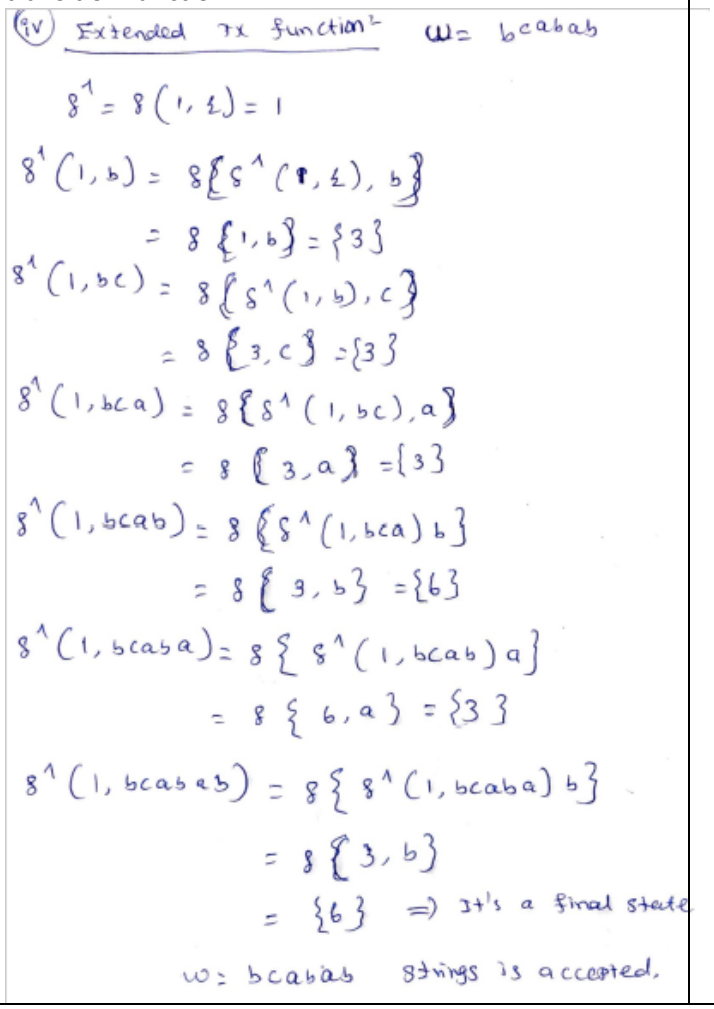
	a	b
q_0	q_0, q_1	q_0
q_1	ϕ	q_2
q_2	ϕ	q_3
q_3	ϕ	ϕ

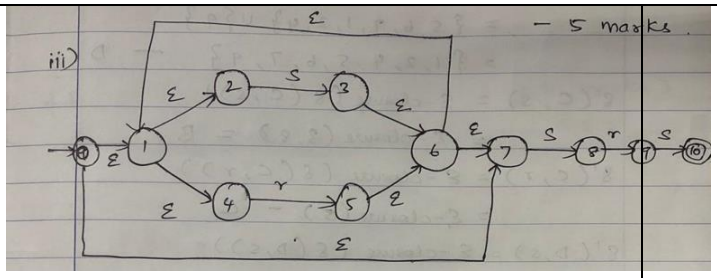
iv. Convert the NFA to DFA.

Now let us convert it to equivalent DFA.

		a	b
	$[q_0, q_1]$	$[q_0, q_1]$	$[q_0, q_2]$
→	q_0	$[q_0, q_1]$	q_0
	q_1	ϕ	q_2
	q_2	ϕ	q_3
	$[q_0, q_2]$	$[q_0, q_1]$	$[q_0, q_3]$
*	$[q_0, q_3]$	$[q_0, q_1]$	q_0
*	q_3	ϕ	ϕ

						
	(OR)					
2.	i. Which of the following options is correct? Statement x: Initial State of NFA is Initial State of DFA. Statement y: The final state of DFA will be every combination of final state of NFA. (i) Statement x is true and Statement y is true (ii) Statement x is true and Statement y is false (iii) Statement x can be true and Statement y is true (iv) Statement x is false and Statement y is also false	1	L_1	1	2	2.5.3
	ii. What is wrong in the given definition? Def: ({q0, q1, q2}, {0,1}, δ, q3, {q3}) (a) The definition does not satisfy 5 Tuple definition of NFA (b) There is no transition definition (c) Initial and Final states do not belong to the Graph (d) Initial and final states can't be same	1	L_1			
	iii. Priya and Kathir are playing a game. They are asked to recite string in such a way that the words start and end with same letter on input {a,b,c}. Create a DFA for the same with a special mention to 5 tuple structure.	5	L_4			
		6	L_5			

	iv. Choose any acceptable input string and show that the input is accepted in the DFA and check the extended transition function.  (iv) Extended Tx function: w = bcabab $\delta^1 = \delta(1, \varepsilon) = 1$ $\delta^1(1,b) = \delta\{\delta^1(1,\varepsilon), b\}$ $= \delta\{1,b\} = \{3\}$ $\delta^1(1,bc) = \delta\{\delta^1(1,b), c\}$ $= \delta\{3,c\} = \{3\}$ $\delta^1(1,bca) = \delta\{\delta^1(1,bc), a\}$ $= \delta\{3,a\} = \{3\}$ $\delta^1(1,bcab) = \delta\{\delta^1(1,bca), b\}$ $= \delta\{3,b\} = \{6\}$ $\delta^1(1,bcaba) = \delta\{\delta^1(1,bcab), a\}$ $= \delta\{6,a\} = \{3\}$ $\delta^1(1,bcabab) = \delta\{\delta^1(1,bcaba), b\}$ $= \delta\{3,b\}$ $= \{6\}$ => It's a final state w: bcabab strings is accepted.					
Part – B (12 x 1 = 12 Marks)						
3.	Ajay wants to build a pattern block. He has two blocks of shapes square and rectangle respectively. All the blocks are in the box and he picks the shapes in a specific order. He picks any blocks and makes the pattern but the pattern should end with a square block, rectangle block and square block. If he can build the pattern in this specified order then he successfully builds the pattern block. Help Ajay to successfully build the pattern. i. Construct a regular expression for the above scenario. **ANSWER :** (s+r)* srs ii. Distinguishable states_____. a) Move to same output state for same input b) Move to different output state for same input c) Move to same output state for all inputs d) Move to same output state for unique inputs iii. Convert the constructed regular expression to ε-NFA.	1 1 5 5	L_1 L_1 L_2 L_2	1	2	2.1.1



— 5 marks.

iv. Convert the ε-NFA to DFA.

iv) ε-NFA - DFA (5 marks)

ε-closure(0) = {0, 1, 2, 4, 7} — A.

δ'(A, a) = ε-closure(δ(A, a))

δ'(A, s) = ε-closure(δ(A, s))
= ε-closure(3, 8) = {3, 6, 1, 2, 4, 7} ∪ {8}
= {1, 2, 3, 4, 6, 7, 8} — B.

δ'(A, r) = ε-closure(δ(A, r))
= ε-closure(5) = {5, 6, 1, 2, 4, 7} — C

δ'(B, s) = ε-closure(δ(B, s))
= ε-closure(3, 8) = B

δ'(B, r) = ε-closure(δ(B, r))
= ε-closure(5, 9)
= {5, 6, 7, 1, 2, 4} ∪ {9}
= {1, 2, 4, 5, 6, 7, 9} — D

δ'(C, s) = ε-closure(δ(C, s))
= ε-closure(3, 8) = B.

δ'(C, r) = ε-closure(δ(C, r))
= ε-closure(5) = C

δ'(D, s) = ε-closure(δ(D, s))
= ε-closure(3, 8, 10)
= {3, 6, 7, 1, 2, 4, 8, 10} — E

δ'(D, r) = ε-closure(δ(D, r))
= ε-closure(5) = C

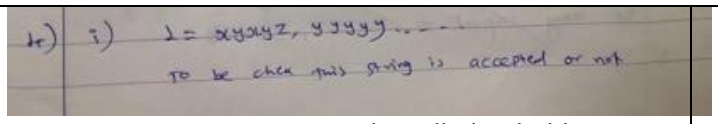
δ'(E, s) = ε-closure(δ(E, s))
= ε-closure(3, 8) = B

δ'(E, r) = ε-closure(δ(E, r))
= ε-closure(5, 9) = D

	s	r
→ A	B	C
B	B	D
C	B	C
D	E	C
* E	B	D

(OR)

4.	Two friends Priya and Radha have created a website and they want to set password for their application. They make a clue code using the following rules. i. The code should start with letters {x,y,z}. ii. The fourth symbol from the right end should be y. 1. Choose any acceptable input string and show that the input is accepted in the DFA.	 1 1	 L_1 L_1	1	2	2.1.2

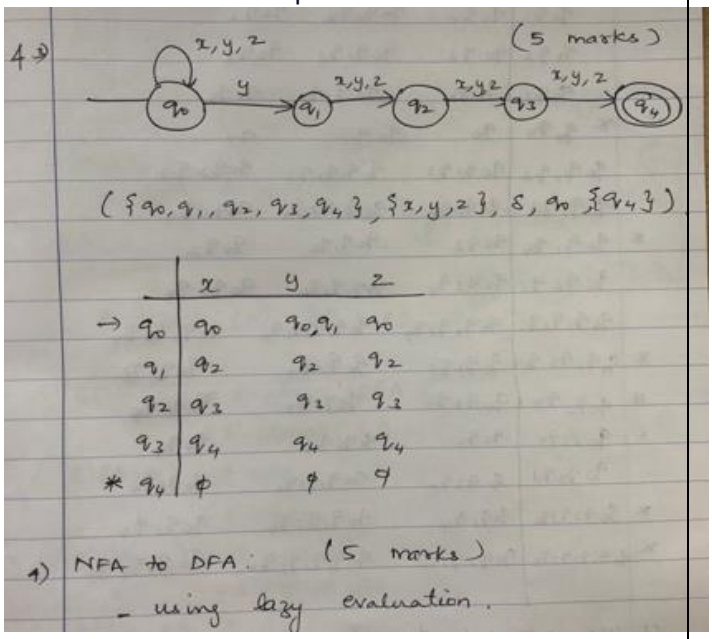


2. **Statement a:** ε- transition can be called as hidden non-determinism.
   Statement b: δ (q, ε) = p means from q it can jump to p with a shift in read head.
   Which among the following options is correct?
   i. Statement a and b, both are correct
   ii. Statement a and b, both are wrong
   iii. Statement a is correct while Statement b is wrong
   iv. Statement a is wrong while Statement b is correct

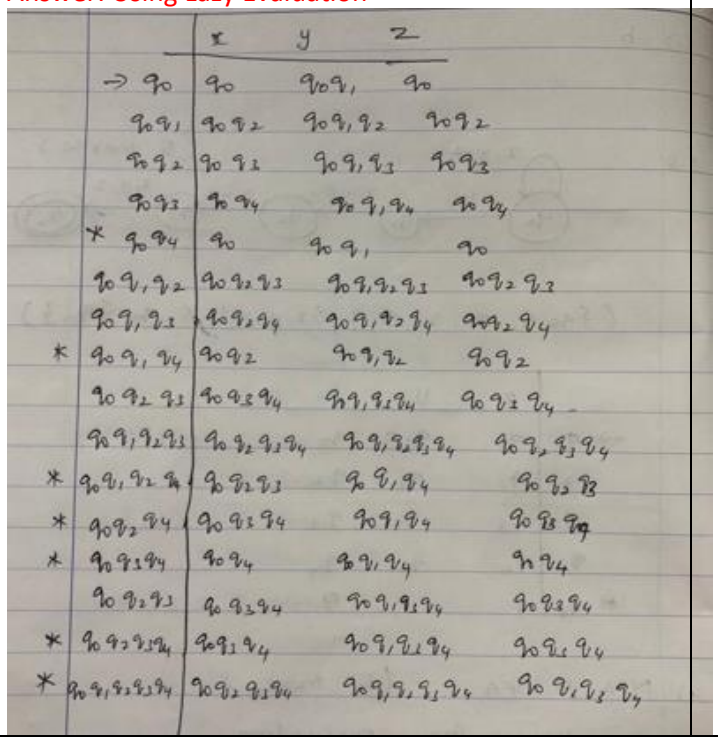
   5 L_2

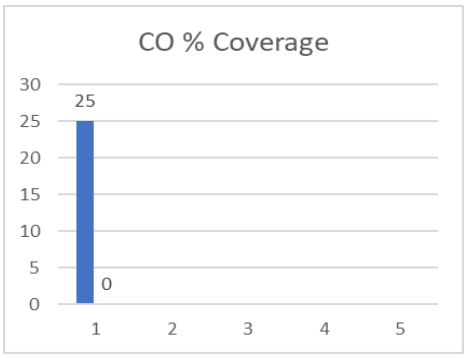
3. Help Priya and Radha to create a NFA for this password scheme. Give the five-tuple structure for this NFA.

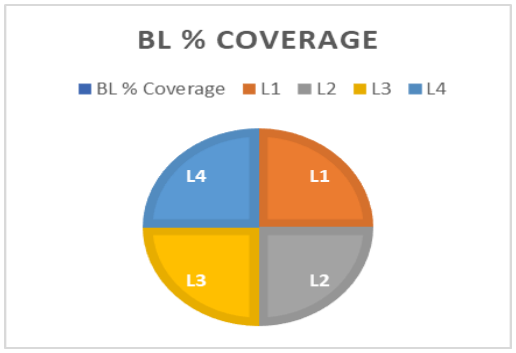
   5 L_2



4. Convert the constructed NFA to DFA.
   Answer: Using Lazy Evaluation







Approved by Audit Professor / Course Coordinator