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)

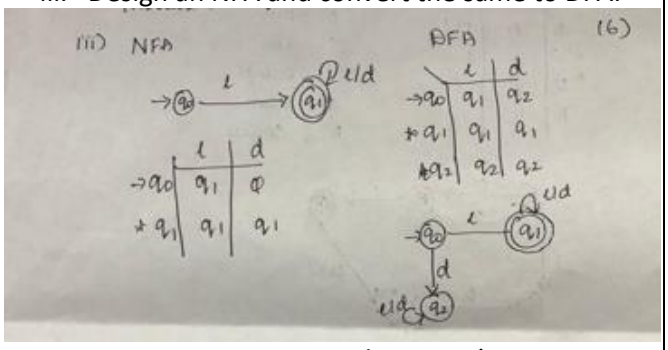
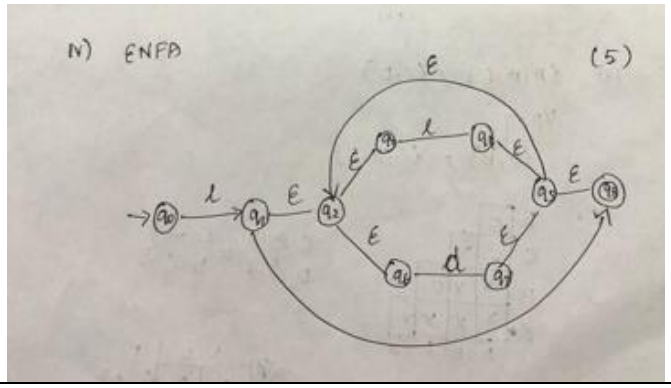
Mode of Exam
OFFLINE
(OPEN BOOK)
SET C

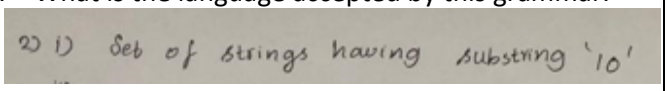
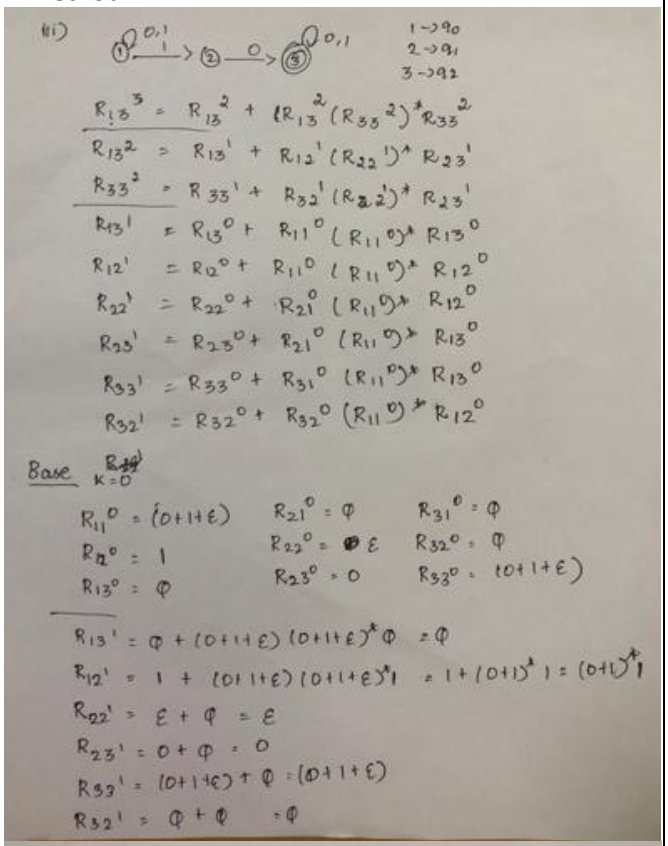
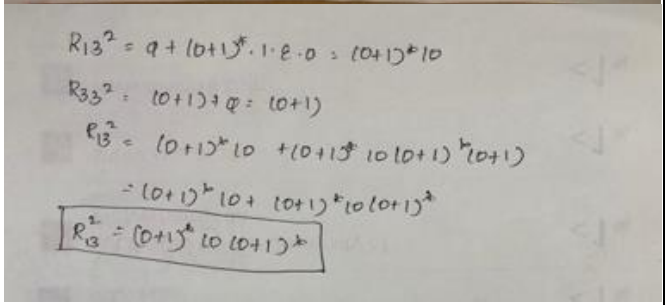
Test: CLAT-1 **Date:16-08-2023**
Course Code & Title: 18CSC301T - Formal Language and Automata **Duration: 50 minutes**
Year & Sem: III-Year & V-Semester **Max. Marks: 25**

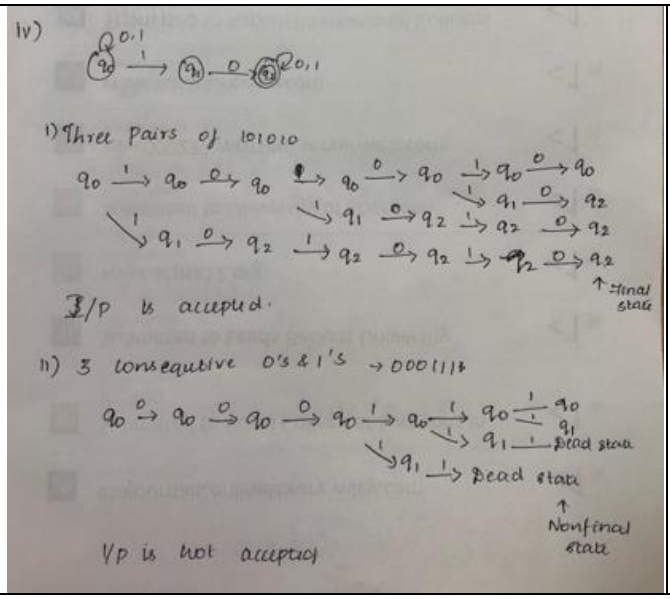
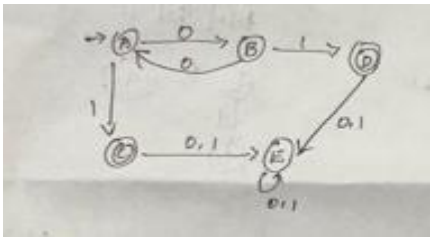
Course articulation matrix:

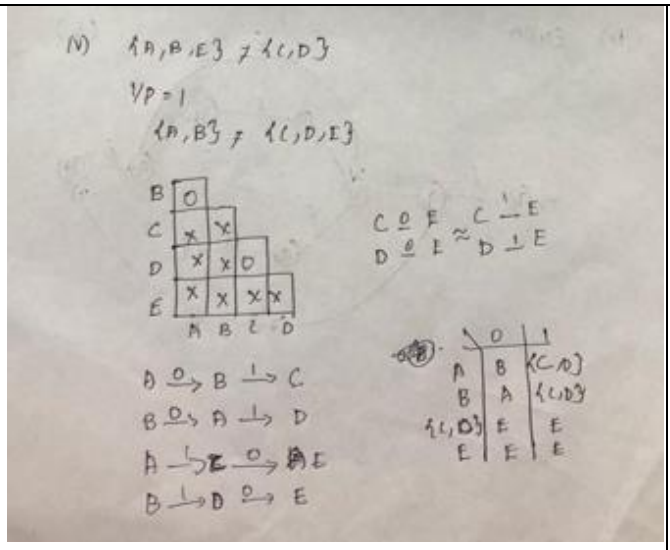
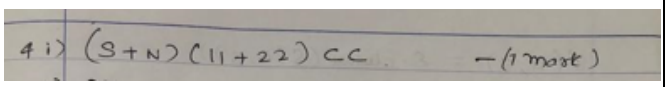
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3														3
CO-2		3	2												3
CO-3		3	3												3
CO-4		3	3												3
CO-5			3	1									2		3

Part – A (13 x 1 = 13 Marks)

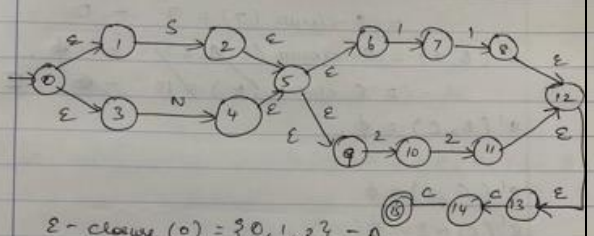
Q. No	Question	Marks	BL	CO	PO	PI Code
1	A software engineer is working on developing a compiler for a programming language. In initial phase the rule for naming an identifier is set. The rules are An identifier must start with a letter (a-z or A-Z). After the initial character, it can have zero or more occurrences of letters or digits (0-9)			1	2	2.5.2
	i. Which one is an equivalent regular expression for the identifier? a) Letter.digit* c) Letter(Letter|digit)* b) (letter|digit)+ d) (letter|digit)*	1	L_1			
	ii. Give an example of valid and invalid string that belongs to the language. Answer: Valid String – abc Invaid String - qa	1 6	L_1 L_4			
	iii. Design an NFA and convert the same to DFA. 	5	L_5			
	iv. Design a Ɛ- NFA using Thompson's Construction for the identifier. 					
	(OR)					

2	"XYZ Electronics" is a company that manufactures electronic gadgets. They have a state machine implemented as a Non-Deterministic Finite Automaton (NDFA) to control the assembly line of their flagship product, a smartphone. The NDFA has become quite complex over time, and they want to replace it with a more manageable regular expression. As a software engineer, you are assigned the task of converting the NDFA to an equivalent regular expression. It should satisfy the following conditions: • The string must start with '0' or '1'. • The string should have substring '10' • The string must end with '0' or '1'.			1	2	2.5.2
	i. What is the language accepted by this grammar.  2) i) Set of strings having substring '10'	1 1	L_1 L_1			
	ii. What will be the no of states in NFA satisfying the above criteria. a) 2 b) 3 c) 4 d) 5	6	L_4			
	iii. Convert the NFA to Regular expression using R_{ij} method.  	5	L_5			
	iv. Check whether a string formed by "three pairs of 10" and "three consecutive 0's and 1's" will be accepted by the language.					

	iv)  					
Part – B (12 x 1 = 12 Marks)						
3	A person wants to analyse his travel path from native to school and college through bus and car. From source station by travelling through bus they reached station 'B'and by travelling through car they reached "college". From B by travelling through bus they reached the source station itself whereas by travelling through car they reached "school". Person after reaching "school and college" left to nearby location "E" by travelling via bus and car. Person visited all the places in location "E" by car and bus. i) Given a DFA with 8 states, what is the maximum number of equivalence classes that can exist after minimization? a) 4 b) 8 c)16 d) 20 ii) How many no of states are involved in the above scenario. a) 5 b) 4 c) 6 d)7 iii) Draw the transition diagram and transition table for the above scenario.  iv) Write the minimized DFA for the above diagram.	1 1 5 5	L_1 L_1 L_2 L_2	1	2	2.1.1

						
	(OR)					
4	Consider that you have started a cricket club. You need to design a tournament registration form to sign up new team for their upcoming competitions. i. Create a regular expression in the following format to capture information about the cricket players team: Where the first letter starts with capital letters S or N and are followed by team number with a substring 11 or 22 and ending with CC. Answer:  ii. How many strings are possible over the alphabet Σ = {S,U,N}. Answer: 27 iii. Construct a deterministic automaton for the defined team so that it would be easier for the cricket club association members to identify the team.	1 1 5 5	L_1 L_1 L_2 L_2	1	2	2.1.1

iii) ε-NFA to NFA



ε-closure (0) = {0, 1, 3} - A.

$\delta'(A, S) = \varepsilon$-closure $(\delta(A, S))$

$= \varepsilon$-closure $(2) = \{2, 5, 6, 9\}$. - B

$\delta'(A, N) = \varepsilon$-closure $(\delta(A, N))$

$= \varepsilon$-closure $(4) = \{4, 5, 6, 9\}$. - C

$\delta'(A, 1) = \varepsilon$-closure $(\delta(A, 1))$

$= \varepsilon$-closure $(\phi) = \phi$.

$\delta'(A, 2) = \phi$

$\delta'(A, C) = \phi$.

$\delta'(B, S) = \varepsilon$-closure $(\delta(B, S))$

$= \phi$

$\delta'(B, N) = \phi$

$\delta'(B, 1) = \varepsilon$-closure $(\delta(B, 1))$

$= \varepsilon$-closure $(7) = 7$ - D

$\delta'(B, 2) = \varepsilon$-closure $(\delta(B, 2)) = \phi$.

$= \varepsilon$-closure $(10) = 10$ - E.

$\delta'(B, C) = \phi$.

$\delta'(C, S) = \phi$

$\delta'(C, N) = \phi$

$\delta'(C, C) = \phi$

$\delta'(C, 1) = \varepsilon$-closure $(\delta(C, 1)) = \varepsilon$-closure $(7) = D$

$\delta'(C, 2) = \varepsilon$-closure $(\delta(C, 2)) = \varepsilon$-closure $(10) = 10 = E$

$\delta'(D, S) = \phi$

$\delta'(D, N) = \phi$

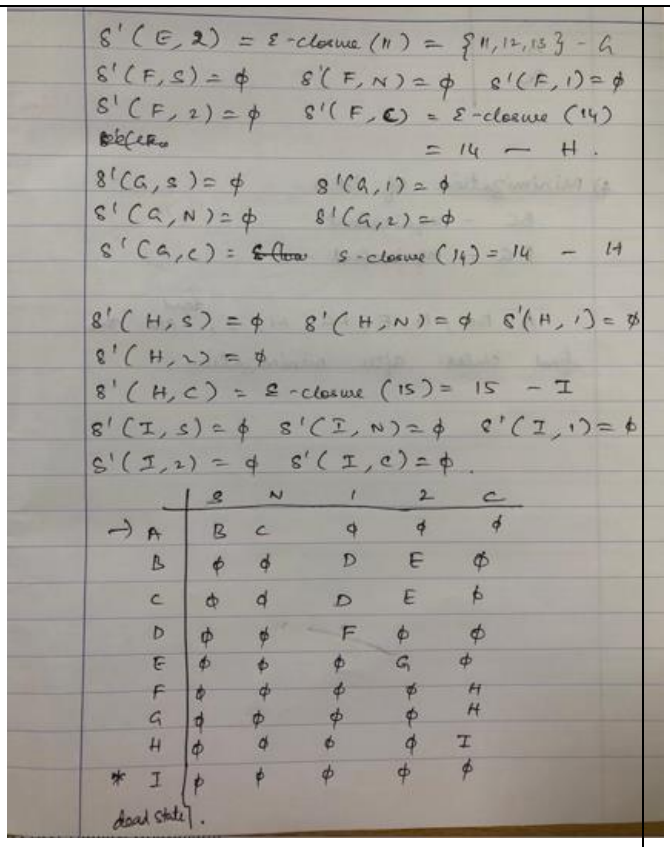
$\delta'(D, C) = \phi$

$\delta'(D, 1) = \varepsilon$-closure $(8) = \{8, 12, 13\}$ - F

$\delta'(D, 2) = \phi$

$\delta'(E, S) = \phi$ $\quad \delta'(E, 1) = \phi$

$\delta'(E, N) = \phi$ $\quad \delta'(E, C) = \phi$



$\delta'(E, 2) = \varepsilon\text{-closure}(11) = \{11, 12, 13\} - G$

$\delta'(F, S) = \phi \quad \delta'(F, N) = \phi \quad \delta'(F, 1) = \phi$

$\delta'(F, 2) = \phi \quad \delta'(F, C) = \varepsilon\text{-closure}(14)$

$= 14 \rightarrow H.$

$\delta'(G, S) = \phi \quad \delta'(G, 1) = \phi$

$\delta'(G, N) = \phi \quad \delta'(G, 2) = \phi$

$\delta'(G, C) = \varepsilon\text{-closure}(14) = 14 - 14$

$\delta'(H, S) = \phi \quad \delta'(H, N) = \phi \quad \delta'(H, 1) = \phi$

$\delta'(H, 2) = \phi$

$\delta'(H, C) = \varepsilon\text{-closure}(15) = 15 - I$

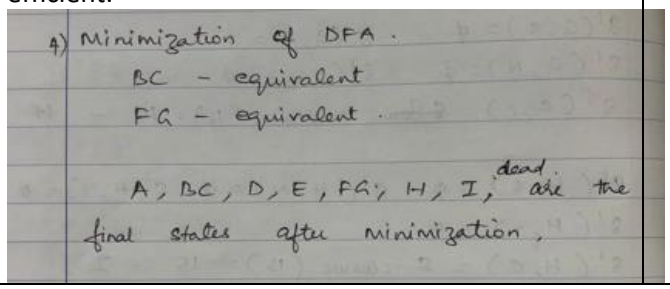
$\delta'(I, S) = \phi \quad \delta'(I, N) = \phi \quad \delta'(I, 1) = \phi$

$\delta'(I, 2) = \phi \quad \delta'(I, C) = \phi.$

	S	N	1	2	C
→ A	B	C	ϕ	ϕ	ϕ
B	ϕ	ϕ	D	E	ϕ
C	ϕ	ϕ	D	E	ϕ
D	ϕ	ϕ	F	ϕ	ϕ
E	ϕ	ϕ	ϕ	G	ϕ
F	ϕ	ϕ	ϕ	ϕ	H
G	ϕ	ϕ	ϕ	ϕ	H
H	ϕ	ϕ	ϕ	ϕ	I
* I	ϕ	ϕ	ϕ	ϕ	ϕ

dead state.

v. Find the minimal states so that it would be time efficient.

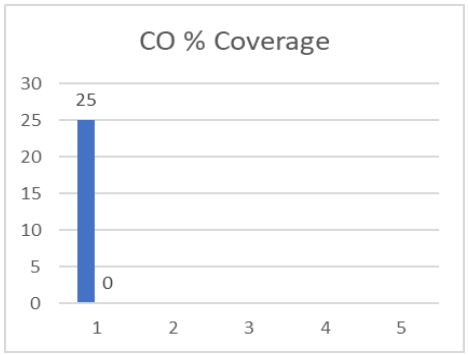


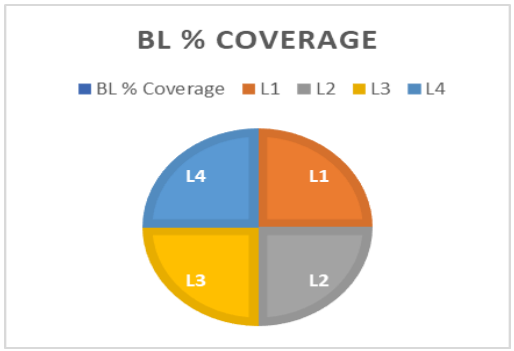
4) Minimization of DFA.

BC - equivalent

FG - equivalent.

A, BC, D, E, FG, H, I, dead are the final states after minimization.





Approved by Audit Professor / Course Coordinator