Register number _____

B

SRM Institute of Science and Technology
College of Engineering and Technology
School of Computing
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu

Academic Year: 2022-23 (ODD)

B.Tech-Computer Science & Engineering

Test: CLA-T1 **Date: 16.08.2023**

Course Code & Title: 18CSC301T & Formal Languages and Automata Theory

Duration: 1 period

Year & Sem: III Year /V Sem **Max. Marks: 25**

Set -A

Course articulation matrix:

PLO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M	H	-	M	L	-	-	-	L	L	-	H
CO2	M	H	L	M	L	-	-	-	M	L	-	H
CO3	M	H	M	H	L	-	-	-	M	L	-	H
CO4	M	H	M	H	L	-	-	-	M	L	-	H
CO5	H	H	M	H	L	-	-	-	M	L	-	H
CO6	L	H	-	H	L	-	-	-	L	L	-	H

Part - A

Instructions: Answer all

Q. No	Question	Marks	BL	CO	PO	PI Code
1a)	A package assembling unit in a company is used to assemble packages to a buyer. The package can be in Yellow or Purple. A scanner is used to accept the package only if the code on it follows the below prescribed rules. A yellow package code starts with Y followed by a string of 1's and 0's with even number of 0's. A purple package code starts with P followed by a string of 1's and 0's with odd number of 1's.					
	i) The maximum possible states in the conversion of a NFA with n states to a DFA is --------- a) 2*n b) n(2n-1) c) 2^n d) n(n-2)	1 1 4 4 3	1 1 3 2 2	2 1 1 1 1	2 2 1 1 1	1.6.1 1.6.1 1.6.1 1.6.1 1.6.1
	ii) A language is said to be ---------- if it is accepted by some DFA. a) closed b) regular c) irregular d) balanced					
	iii) Design a €-NFA or NFA for the above scanner to accept or reject package codes.					
	iv) Convert the above to a Deterministic Finite Automata					
	v) Check if the DFA constructed can be minimized.					

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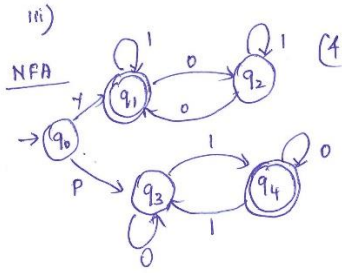
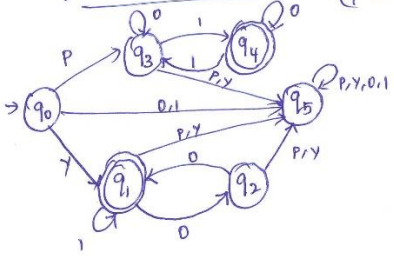
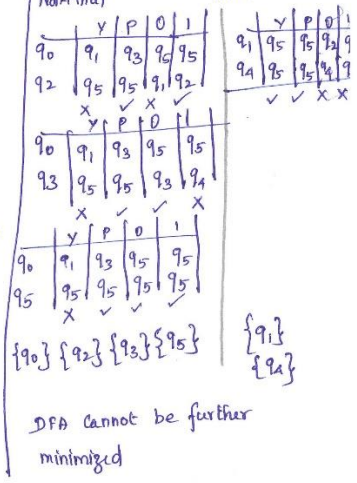
	Part-A 1.a) i) 2^n Option c ii) regular Option c. iii) NFA (4 marks)  iv) Convert to DFA (4 marks)  v) Minimize DFA. (3marks) Zero equivalence {q0, q2, q3, q5} {q1, q4} Non-Final Final  DFA cannot be further minimized					
	(OR)					
1b)	A children event bazaar sells tickets for different donor organizations and original buyers. The donor organization's tickets are eligible for a discount return with their ticket code. The ticket is tapped on a special machine for discounted price returns. The ticket code of donor organizations has a special pattern which is recognized by the machine. The ticket code is generated with symbols '0' and '2'. The donor organization ticket machine accepts codes that are of length five or more in which the fourth character from the right end is different from the leftmost character.					
	i) Which of the following is True with respect to a DFA and NFA that accepts the same language. a) NFA is more powerful than DFA b) NFA and DFA are equal in power c) DFA is more powerful than DFA d) It is not fixed. Either DFA or NFA could be more powerful based on the problem.	1 1 7 4	1 1 3 2	1 1 1 1	1 2 2 1	1.6.1 1.6.1 1.6.1 1.6.1
	ii) Which of the one below is a dead configuration in a NFA? a) $\delta(\{q_0\},a) = \{q_1,q_2\}$ b) $\delta(\{q_0\},a) = \phi$ c) $\delta(\{q_1,q_2\},a) = \{q_1,q_2\}$ d) $\delta(\{q_1,q_2\},b) = \{q_0\}$					
	iii) Design a DFA for the ticket checking machine for the donor ticket.					
	iv) Represent the transition table for the entire DFA and the transition function for the ticket code "022002020" acceptance or rejection with the constructed DFA					

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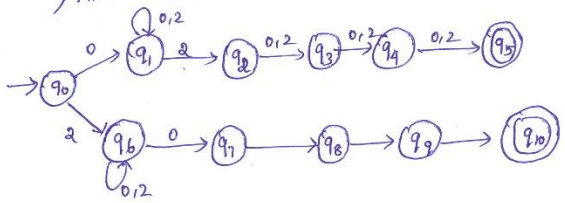
	1b) i) b) NFA and DFA are equal in power ii) b) $\delta(\{q_0\}, a) = \phi$ iii) Finite automata.  iv) Tracing of "022002020" $\delta(q_0, "022002020")$ $\delta(q_0, 0) \rightarrow q_1$ $\delta(q_1, "22002020") \rightarrow q_1$ $\delta(q_1, "2002020") \rightarrow q_1$ $\delta(q_1, "002020") \rightarrow q_1$ $\delta(q_1, "02020") \rightarrow q_1$ $\delta(q_1, "2020") \rightarrow q_2$ $\delta(q_2, "020") \rightarrow q_3$ $\delta(q_3, "20") \rightarrow q_4$ $\delta(q_4, "0") \rightarrow q_5$ (Accepted) Error typo – NFA given as DFA in question. NFA solution provided above. If DFA attempted upto 30% full marks can be provided, since DFA is lengthy					
2a)	A specific VPN token traff0069c protocol of a secured private network accepts packet headers composed of 0's and 1's only if it follows a sequence. The packet header length could be a multiple of 3 but not a multiple of 5.					
	i) What is the minimum number of states to recognise the language L={w/w ϵ (0+1)+}? a) 1 b) 3 c) 2 d) 4	1 1 5 5	1 1 2 2	1 1 1 2	2 3 2 2	2.6.2 2.6.2 2.6.2 2.6.2
	ii) Which of the below is a valid transaction for a DFA? a) $\delta(\{q_0\}, a, b) = \{q_1\}$ b) $\delta(\{q_2\}, a) = \{q_1, q_2\}$ c) $\delta(\{q_1, q_2\}, a) = \{q_1, q_2\}$ d) $\delta(\{q_1\}, b) = \{q_0, q_2\}$					
	iii) Design a DFA to accept packet headers accordingly along with the transition table.					

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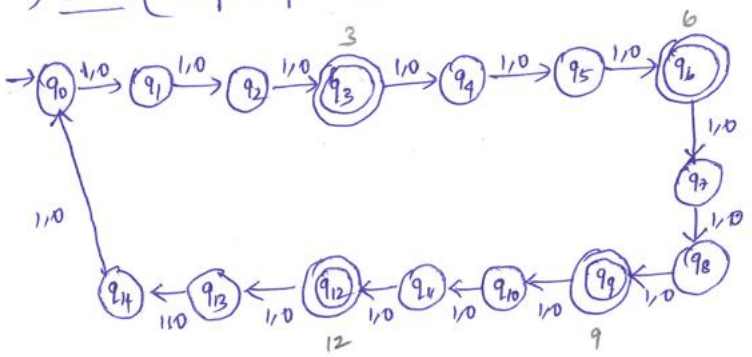
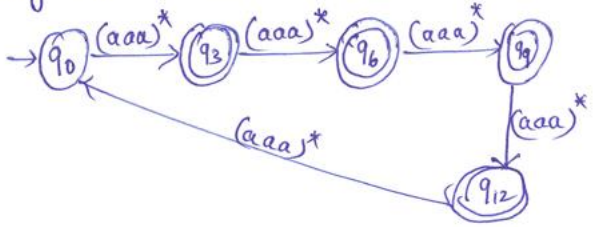
	iv) Convert the above DFA to a regular expression. 2a) i) c) 2 ii) a) $\delta(\{q_0\}, a, b) = \{q_1\}$ iii) DFA (multiple of 3 but not 5) 5 marks  iv) Regular expression for the scenario / conversion 5 marks Let any character 1 or 0 be represented as a. ∴ (1+0) → a. Using state elimination method,  R.E → $(aaa)^* + (aaaaaa)^* + (aaaaaaaaa)^* + (aaaaaaaaaaaa)^*$ 3 6 9 12					
(OR)						
2b)	A packing machine in a confectionary packs items from the conveyor belt according to the order placed by customers. Whatever be the order the first item in the row must be a single Wafer Roll as a reward, followed by Mints and then followed by Tarts. The number of mints has to be minimum 2 or more. The number of tarts has to be minimum 3 or more. The packing machine accepts only if the confectionaries are in this order else rejects the sequence.					
	i) The string 1101 cannot be generated from a) 110*(0+1) b) 1(0+1)*101 c) (10)*(01)*(00+11)* d) (00+(11)*0)*	1 1 6 4	1 1 3 2	2 2 2 2	2 3 2 3	1.6.1 1.6.1 1.6.1 1.6.1
	ii) A non-final state which has no outgoing transitions/arrows from itself to any other state in a DFA is called a ---------- state a) trap					

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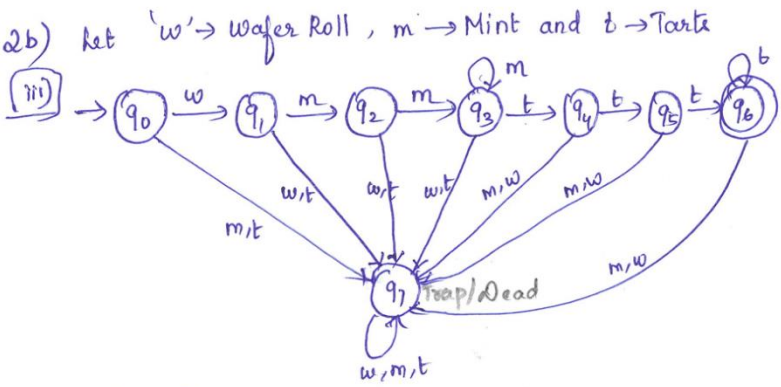
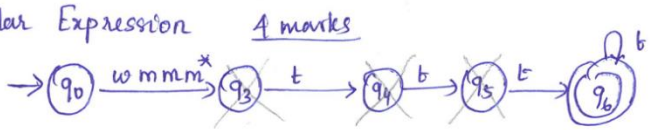
b) unreachable
c) initial
d) self

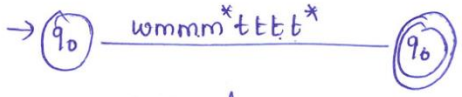
iii) Design a DFA for the packing machine above. Draw the transition table also.

iv) Construct a regular expression for the above DFA



iv) Regular Expression 4 marks





i) Option c or Option d

ii) a) trap