SVKM'S NMIMS

MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT& ENGINEERING /

SCHOOL OF TECHNOLOGY MANAGEMENT& ENGINEERING

Academic Year: 2022-2023

Program/s: B. Tech/MBA Tech — Year: II Semester: IV

Stream/s: Computer Engineering/Computer Science

Subject: Theoretical Computer Science — Time: 03 hrs (10:00 AM to 01:00 PM)

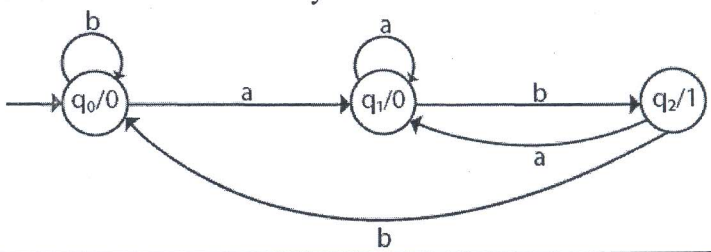
Date: 03 May 2023 — No. of Pages:03

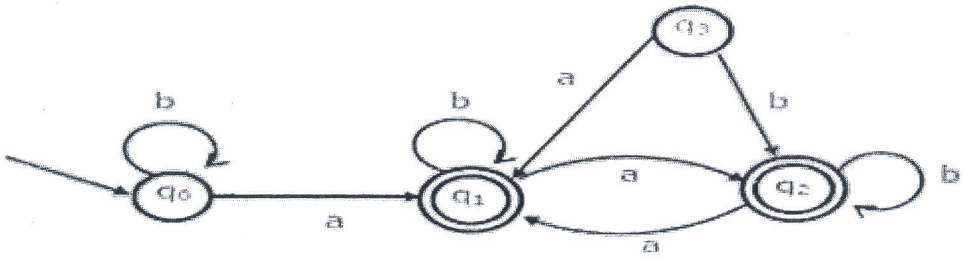
Marks: 100

Final Examination / Re-Examination

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

1) Question No. 1 is compulsory.
2) Out of remaining questions, attempt any 4 questions.
3) **In all 5 questions to be attempted.**
4) All questions carry equal marks.
5) **Answer to each new question to be started on a fresh page.**
6) **Figures in brackets on the right hand side indicate full marks.**
7) **Assume Suitable data if necessary.**

Q1		Solve the following	
CO-1 ; SO-1; BL-2	a.	What do you understand by formal language and finite automata? Explain	[05]
CO-1,2 ; SO-1,2 ; BL-1	b.	Define Regular Expression and convert the following regular expressions into equivalent English statements. R1= b*ab*ab* R2= (a+b)*(aa+bb)(a+b)* R3= a(a+b)*a	[05]
CO-3; SO-2; BL-3	c.	Write context-free grammar for the regular expression (011 + 1)* (01)*.	[05]
CO-1,3; SO-1,2; BL-2	d.	Explain Turing Machine as finite control and tuples of the Turing machine with suitable example.	[05]
Q2			
CO-1,3 ; SO-1,2; BL-2,4	a	What is the difference between the Moore machine and the Mealy machine? Convert the following Moore machine to Mealy Machine. 	[10]

CO-3; SO-2; BL-6	b	Construct the Turing Machine that computes the proper subtraction of two unary numbers. F (x-y) = x-y if x > y = 0 if x ≤ y Simulate the working of machine for input 3-2 and 2-3.	[10]
Q3			
CO-2,3; SO-1,2; BL-3,6	a	Design a Deterministic finite automaton for accepting all the decimal numbers divisible by 3. What are initial strings in the language? Verify the DFA for string w= "31" & w= "45".	[10]
CO-3 ; SO-2; BL-2,6	b	Construct the pushdown automata (PDA) with the final state to recognize the language L and explain all the tuples of constructed PDA. L= $\{a^n bc^n \mid n \geq 0\}$	[10]
Q4			
CO-1,2; SO-1,2; BL-3	a	Using Arden's Theorem obtain a regular expression for the following deterministic finite automata. 	[10]
CO-2; SO-1,2; BL-2	b	Write a short note on the following. i. Universal Turing machine ii. Halting problem	[10]
Q5			
CO-2,3; SO-1,2; BL-2,3	a	Discuss Greibach normal form (GNF) and convert the given context-free grammar to GNF S → AB A A → aA | ε B → bB | ε	[10]
CO-2; SO-1,2 ; BL-2	b	Identify the language generated by the following grammar by constructing various derivation trees and comment on the most suitable grammar class. i. S→aS|bS|a|b ii. S→aSa|bSb|a|b|ϵ	[05]

CO-1,3; SO-1,2; BL-3	c	Convert the following non-deterministic finite automata to deterministic finite automata. Σ / Q: a | b $\rightarrow$p: {p,q} | {q} q^+: {r} | {r} r: ϕ | {r}	[05]
Q6			
CO-2; SO-1,2; BL-1,3	a	Find left most derivation, right-most derivation, and derivation tree for the string "00110101" in the grammar given below and comment on the ambiguity of the grammar: $S \rightarrow 0B \mid 1A$ $A \rightarrow 0 \mid 0S \mid 1AA$ $B \rightarrow 1 \mid 1S \mid 0BB$	[10]
CO-1,2; SO-1,2; BL-1,2	b	State and explain the limitations of the finite state machine (FSM)	[05]
CO-3; SO-2; BL-6	c	Design a Moore machine for residue mod 3 of a binary number.	[05]
Q7			
CO-2 ; SO-1,2; BL-1,3	a	State pumping lemma for regular language and prove L= $\{a^{2n} \mid n \geq 1\}$ is regular language.	[10]
CO-1; SO-1; BL-2	b	The compiler work is divided into a series of phases. The first compiler phase is a lexical analyzer, whose main task is to generate tokens. How is Theoretical Computer Science applicable in the implementation of a lexical analyzer? What are the steps followed by the lexical analyzer to generate tokens?	[05]
CO-2; SO-1,2; BL-2	c	Explain the power of PDA over FSM.	[05]
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