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 July 2023 | No. of Pages:03

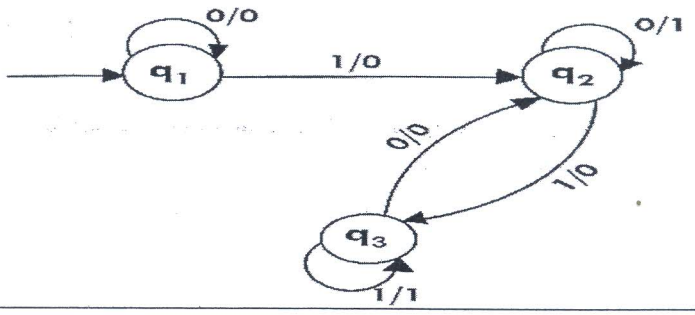
Marks: 100

Re-Examination (2021-22 / 2022-23)

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-1	a.	Define the following terms with examples. i. Alphabet ii. String iii. Language	[05]
CO-1,2; SO-1,2; BL-2,4	b.	What are Finite Automata (FA)? How is FA without output different from FA with output? Explain	[05]
CO-3; SO-2 ; BL-3	c.	Give CFG for the language containing all the strings (over $\Sigma = \{0, 1\}$) in which the first and last symbols differ.	[05]
CO-2; SO-1,2 ; BL-3	d.	Consider the languages L1 and L2 are context-free. Prove that context-free languages are closed under union operation. $L1 = \{a^n \mid n \geq 1\}$ $L2 = \{b^n \mid n \geq 1]$	[05]
Q2			
CO-2,3; SO-1,2; BL-2,6	a	Design a finite state machine over the alphabet {a,b}, such that strings accepted satisfies the following condition. Also, give initial strings in the language and explain all the tuples of constructed machines. Condition: Set of strings with even number of a's and odd number of b's.	[10]

CO-2; SO-1,2; BL-2,4	b	Write a short note on the following. i. Recursive and recursively enumerable language ii. Power of TM over PDA	[10]
Q3			
CO-3; SO-2; BL-2,4	a	Give the formal definition of Mealy and Moore machines. Then, convert the following Mealy Machine to Moore Machine. 	[10]
CO-3; SO-2; BL-6	b	Construct pushdown automata to accept palindrome over $\Sigma = \{a,b\}$	[10]
Q4			
CO-2,3; SO-1,2; BL-3	a	Let G be given by the following grammar: G: $S \rightarrow ASA \mid aB$ $A \rightarrow B \mid S$ $B \rightarrow b \mid \varepsilon$. Convert grammar G into to Chomsky Normal Form (CNF).	[10]
CO-3; SO-2; BL-6	b	Design a Turing Machine to find the reverse of a string over $\Sigma = \{0,1\}$.	[10]
Q5			
CO-3; SO-2; BL-3	a	Consider the following NFA with ϵ-transitions. Assume 'p' as the initial and 'r' as the final state. Convert the following NFA with epsilon moves to equivalent DFA.	[10]

Q \ Σ	ϵ	a	b	c
p	ϕ	{p}	{q}	{r}
q	{p}	{q}	{r}	ϕ
r	{q}	{r}	ϕ	{p}

CO-2; SO-1,2; BL-2,3	b	What is grammar simplification? Simplify the following Context Free Grammar? G = {(S,A,B),(a,b,ϵ),S,P}: productions are given below. S→ASB | ϵ A→aAS | ϵ B→SbS | A | bb	[10]
Q6			
CO-1; CO-1; BL-3,4	a	Solve the following. i. Compare DFA and NFA. ii. Design a regular expression that represent all strings over the alphabet ∑ = {a, b}, - where every accepted string 'w' starts with substring "abb". - where every accepted string 'w' ends with substring "bab". - where every accepted string 'w' contains sub string "aba". - string start and end with same symbols. - string start and end with different symbols.	[10]
CO-1; SO-1; BL-2	b	What is Push Down Automata (PDA)? What are the two different ways to define PDA acceptability?	[05]
CO-2; SO-1,2; BL-3	c	Let G ={(S,A),(a,b),P,S) where P consist of : S → aAS | a A → SbA | SS | ba Derive string "aabbaa" using right most derivation and give derivation tree for same.	[05]
Q7			
CO-2; SO-1,2; BL-1,2	a	State and explain closure properties of regular language	[05]
CO-2; SO-1,2; BL-2	b	Write down the syntax for recognizing Type-2 Grammar and justify your answer with the help of a suitable example.	[05]
CO-3; SO-2; BL-6	c	Construct a Moore machine that determines whether an input string contains an even or odd number of 1's. The machine should give 1 as output if an even number of 1's are in the string and 0 otherwise.	[05]
CO-3; SO-2; BL-6	d	Design a Turing machine to add two unary numbers.	[05]
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