SVKM's NMIMS
MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING / SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Academic Year: 2021-22

Programme: B. Tech / MBA Tech (Computer) Year: II Semester: IV

Subject: Theoretical Computer Science

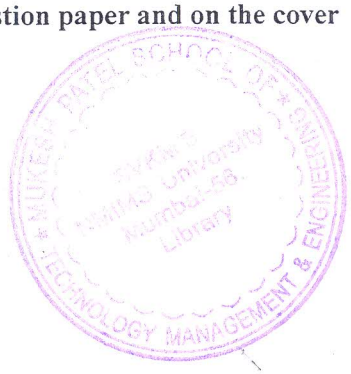
Date: 08 June 2022

Marks: 100
Time: 10.00 am to 1.00pm
Durations: 3 (Hrs)
No. of Pages: 3

Re-Examination (2021-22)

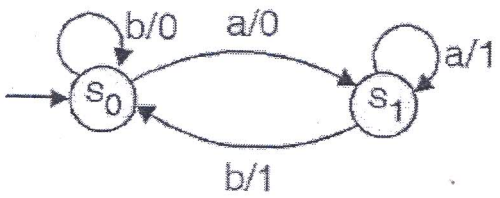
Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

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-2; SO-1,2 ; BL-IV	a.	What is ambiguous grammar? Test the following grammar G for ambiguity, and if G is ambiguous, what is the cause of ambiguity? G ={E , (+,*,a), {E→E+E, E→E*E, E→a} , E}	[5]
CO-3; SO-2 ; BL-VI	b.	Design pushdown automata for the following context-free grammar. S → SS | (S) | ( )	[5]
CO-1 ; SO-1 ; BL-I	c.	Give Formal Definition of Turing Machine & Mealy Machine. How they are different from each other.	[5]
CO-1; SO-1 ; BL-1	d.	What are the applications of Regular Expression and Grammar in Compiler Constructions? Explain.	[5]
Q2 CO-1,3; SO-1,2; BL-I and VI	a.	How is DFA different from NFA? Construct DFA, which accepts all strings ending with 00 or 11 over ∑={0,1}.	[10]
CO-3; SO-2;	b.	Construct & verify Turing machine to recognize the language L= { $a^{n+1}b^n$ | n ≥ 1}	[

<table>
<tr><td>BL-VI</td><td></td><td></td><td></td></tr>
<tr><td>Q3
CO-2;
SO-1,2
BL-V</td><td>a.</td><td>Prove the following languages are closed under operations union, concatenation, and Kleene closure
i. Regular Language
ii. Context Free Language</td><td>[10]</td></tr>
<tr><td>CO-3;
SO-2;
BL-III</td><td>b.</td><td>Consider the following grammar G, apply Chomsky Normal Form (CNF), and construct the equivalent grammar in CNF.
G:
S →AACD
A → aAb | ∈
C → aC | a
D →aDa | bDb | ∈</td><td>[10]</td></tr>
<tr><td>Q4
CO-1,3;
SO-1,2;
BL-III</td><td>a.</td><td>Consider the following transition table for ∈-NFA
<table>
<tr><td></td><td>∈</td><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>→q_0</td><td>q_1</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>q_1</td><td>q_2</td><td>q_0</td><td>q_3</td><td>q_2</td><td>-</td></tr>
<tr><td>q_2^*</td><td>-</td><td>-</td><td>-</td><td>-</td><td>q_2</td></tr>
<tr><td>q_3</td><td>-</td><td>-</td><td>q_1</td><td>-</td><td>-</td></tr>
</table>
Develop Minimal DFA for the above ∈-NFA.</td><td>[10]</td></tr>
<tr><td>CO-3;
SO-2;
BL-VI</td><td>b.</td><td>Design Turing Machine to Compare two numbers, ‘m’ and ‘n’ represented in unary format and produce the following output
‘G’ if m>n
‘S’ if m<n
‘E’ for m=n</td><td>[10]</td></tr>
<tr><td>Q5
CO-3;
SO-2;
BL-VI</td><td>a.</td><td>Construct pushdown automata for the following laguage L,
L={w ∈ {0,1}* | $n_0(w) \neq n_1(w)$ }</td><td>[10]</td></tr>
<tr><td>CO-2,3;
SO-1,2;
BL-IV</td><td>b</td><td>Simplify the following grammar:
S → a | Xb | aYa
X → Y | ∈</td><td>[5]</td></tr>
</table>

		$Y \rightarrow b \mid \in$	
CO-1,3; SO-1,2; BL-II,III	c	Differentiate between Moore and Mealy Machines. Construct the Moore machine for the given Mealy machine. 	[5]
Q6		Solve the following	
CO-2; SO-1,2; BL-II	a	Write a short note on Chomsky Hierarchy	[5]
CO-1; SO-1; BL-II	b	Compare and Contrast Turing Machine, Pushdown Automata & Finite State Machine.	[5]
CO-1; SO-1; BL-I,II	c	What is Pushdown automata? Explain its tuples and elements in a push-down machine.	[5]
CO-2; SO-1,2; BL-II	d	What do you understand by Recursive and recursively enumerable languages? Explain	[5]