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: 12 April 2022

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

Final 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-2; SO-1,2 ; BL-III	a.	Identify Formal Language and its class by constructing various derivation trees by considering following grammar G. G: $S \rightarrow aSa \mid bSb \mid \epsilon$	[5]
CO-1 ; SO-1 ; BL-IV	b.	Distinguish between pushdown automata and deterministic finite automata	[5]
CO- 2; SO- 1,2; BL-I,II	c.	What are the various closure properties of context-free languages? Explain	[5]
CO-1,2 ; SO- 1,2; BL-I,II	d.	Define and explain universal Turing machine	[5]
Q2 CO-1,3; SO-1,2; BL-I,VI	a.	What is formal definition of Turing Machine? Construct a Turing machine to create a copy of the input over {a,b}	[10]

CO-1,3; SO-1,2; BL-I,VI	b.	What is formal definition of pushdown automata (PDA)? Design a PDA for accepting a language $L= \{a^n b^{2n} \mid n>=1\}$.	[10]
Q3 CO-3; SO-2; BL-VI	a.	Construct DFA in which number of 'a' is divisible by 3 and number of 'b' is divisible by 2, $L=\{n_a(w)=0 \bmod 3$ and $n_b(w) =0 \bmod 2\}$	[10]
CO-3; SO-2; BL- II, III	b.	Explain Greibach Normal Form (GNF), Consider the following grammar G, apply GNF and construct the equivalent grammar in GNF. $S \rightarrow AB$ $A \rightarrow BS \mid a$ $B \rightarrow SA \mid b$	[10]
Q4 CO-1,3; SO-1,2; BL-I,VI	a.	How Moore machine is different from Mealy machine? Give the Mealy and Moore Machine for the following processes, "For input from (0+1)*, If inputs end in 101, the output is x, if the input ends in 110, the output is y; otherwise the output is z".	[10]
CO-2; SO-1,2; BL-II	b.	Differentiate between Type 0, Type 1, Type 2, and Type 3 Grammar.	[5]
CO-2; SO-1,2; BL-I,II	c	What is Halting Problem? Explain	[5]
Q5 CO-1,2; SO-1,2; BL-I,III	a.	What is Arden's Theorem? Apply Arden's theorem to convert the following DFA to RE. $\rightarrow q_0$: - , q1 q_1 : q2 , q1 q_2 : q2 , q3 q_3* : q2 , q1	[10]
CO-1,3; SO-1,2; BL-I,VI	b	What is Context Free Grammar (CFG)? Construct CFG for the following languages i) $L = (011 + 100)^*$ ii) $L = (0^* 1 0^* 1 0^*)$	[5]

<table>
<tr><td>CO-1,3;
SO-1,2;
BL-I,III</td><td>c</td><td>Write the Formal definition of Moore Machine. Convert the given transition table in Moore machine to Mealy machine.
<table><tr><th>Q</th><th>∑=0</th><th>∑=1</th><th>Δ</th></tr><tr><td>→A</td><td>E</td><td>C</td><td>ϵ</td></tr><tr><td>B</td><td>E</td><td>C</td><td>1</td></tr><tr><td>C</td><td>B</td><td>F</td><td>0</td></tr><tr><td>D</td><td>B</td><td>F</td><td>1</td></tr><tr><td>E</td><td>D</td><td>B</td><td>0</td></tr><tr><td>F</td><td>G</td><td>E</td><td>0</td></tr><tr><td>G</td><td>G</td><td>E</td><td>1</td></tr></table></td><td>[5]</td></tr>
<tr><td>Q6</td><td></td><td>Consider the following Language L.
$L = \{WW^R \mid W \in (a, b)^*$, and W^R is the reverse of W$\}$</td><td></td></tr>
<tr><td>CO-2,3;
SO-1,2;
BL-III,VI</td><td>a</td><td>Design the grammar for language L and identify its class.</td><td>[5]</td></tr>
<tr><td>CO-2;
SO-1,2;
BL-III</td><td>b</td><td>Using above grammar, For the string ‘ababbaba’ find the following
i) leftmost derivation
ii) derivation tree</td><td>[5]</td></tr>
<tr><td>CO-3;
SO-2;
BL-VI</td><td>c</td><td>Design a Pushdown Automata to recognize language L.</td><td>[5]</td></tr>
<tr><td>CO-3;
SO-2;
BL-VI</td><td>d</td><td>Construct Turing Machine to recognize language L.</td><td>[5]</td></tr>
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