PAPER ID-410975

Roll No: | | | | | | | | | | | | | |

MCA
(SEM II) THEORY EXAMINATION 2023-24
THEORY OF AUTOMATA & FORMAL LANGUAGES

TIME: 3 HRS **M.MARKS: 100**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief.

Qno.	Question	Marks	CO
a.	What do you mean by Formal languages?	2	1
b.	What do mean by acceptability of string?	2	1
c.	State the Kleen's Theorem.	2	2
d.	Write down the Closure properties of Regular Languages.	2	2
e.	Differentiate Right Linear and Left Linear grammars.	2	3
f.	What do you mean by simplification of CFG?	2	3
g.	What do you mean by ambiguity in CFG?	2	4
h.	Define Nondeterministic Pushdown Automata.	2	4
i.	Define Linear Bounded automata.	2	5
j.	What do you mean by Halting Problem?	2	5

SECTION B

2. Attempt any *three* of the following:

a.	Convert the following Mealy machine into an equivalent Moore machine: **Mealy Machine Transition Table**	10	1	
b.	Explain the difference between Regular and Non-Regular Languages with suitable examples.	10	2	
c.	Find the derivation tree for the generating the $string$ 11001010from the following grammar: $S \rightarrow 1B\|0A,\ A \rightarrow 1\|1S\|0AA,\ B \rightarrow 0\|0S\|1BB$.	10	3	
d.	Construct the PDA to accept the following language: $L = \{a^{2n}b^n\ where\ n > 0\}$.	10	4	
e.	What do you mean by Non-deterministic Turing Machine. Also construct a TM over $\{a, b\}$ $which\ contains\ a\ substring\ abb$.	10	5	

$PresentState$	$NextState$			
	$a = 0$		$a = 1$	
	State	Output	State	Output
$\rightarrow q_0$	q_2	0	q_1	0
q_1	q_0	1	q_3	0
q_2	q_1	1	q_0	1
q_3	q_3	1	q_2	0

SECTION C

3. Attempt any *one* part of the following:

a.	Check whether the$strings$ **00101 *and* 110010**areaccepted or not by the following FA:	10	1

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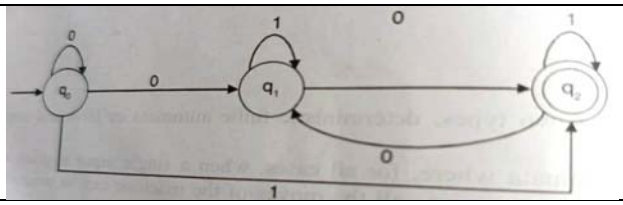
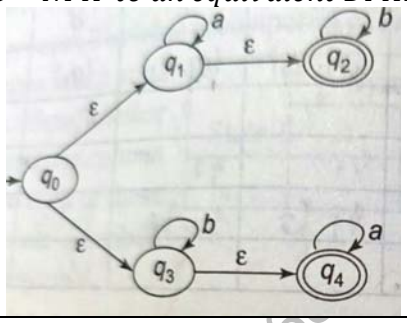
			
b.	Convert the following $\varepsilon - NFA$ *to an equivalent DFA*: 	10	1

4. Attempt any *one* part of the following:

a.	State and prove Arden's theorem.	10	2
b.	Construct an Finite Automata equivalent to the Regular expression given by: $R = (00 + 11)^*11(0 + 1)^*0$.	10	2

5. Attempt any *one* part of the following:

a.	Construct CFG for the regular expression: $R = (0 + 1)^*01^*$	10	3
b.	Give the following CFG having Sas start symbol, find an equivalent CFG with *no useless symbols*. $S \rightarrow AB \mid CA,\ A \rightarrow a,\ B \rightarrow BC \mid AB,\ C \rightarrow aB \mid b$	10	3

6. Attempt any *one* part of the following:

a.	Prove that the language: $L = \{a^{i^2} : where\ i \geq 1\}$*is not context free.*	10	4
b.	Construct a PDA that accepts the language generated by the following grammar: $S \rightarrow aB,\ B \rightarrow bA \mid bA \rightarrow aB$.	10	4

7. Attempt any *one* part of the following:

a.	Design a TM for a set of all *strings with equal number of* a *and* b.	10	5
b.	Define recursive function. Prove that the function: $f(x) = \begin{cases} \frac{x}{2}\ if\ \ x\ is\ even \\ \frac{x-2}{2} \quad if\ \ x\ \ is\ odd \end{cases}$	10	5