Code No.: CS504PC | R20 | H.T.No. | | | 8 | R | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–I–Semester End Examinations (Supply) - December- 2024
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common for CSE, IT, CSC, CSM)

[Time: 3 Hours] **[Max. Marks: 70]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks.

PART-A **20 Marks)**

1. a)	Provide a formal definition of NFAs.	[2M]
b)	Define Moore and Mealy machines.	[2M]
c)	List the advantages of DFA.	[2M]
d)	Define the closure properties of regular expression.	[2M]
e)	Explain context-free grammar (CFG).	[2M]
f)	Define sentential forms in the context of CFGs.	[2M]
g)	State the pumping lemma for context-free languages (CFLs).	[2M]
h)	Define Greibach Normal Form (GNF) for a CFG.	[2M]
i)	What is counter machines?	[2M]
j)	Define recursive languages.	[2M]

PART-B **(50 Marks)**

2. Explain how finite automata are used to solve problems and how these problems are classified based on complexity. [10M]

OR

3. Given the DFA with states {q0, q1, q2}, alphabet {a, b}, start state q0, accept state q2, and transition function $\delta(q0, a) = q1$, $\delta(q0, b) = q0$, $\delta(q1, a) = q1$, $\delta(q1, b) = q2$, $\delta(q2, a) = q1$, $\delta(q2, b) = q0$, determine whether the DFA accepts the string "abaa". [10M]

4. Minimize the following DFA and provide the minimized DFA: States: [10M]
{A, B, C, D, E}
Alphabet: {0, 1}
Transition function:
$\delta(A, 0) = B$
$\delta(A, 1) = C$
$\delta(B, 0) = A$
$\delta(B, 1) = D$
$\delta(C, 0) = D$
$\delta(C, 1) = A$
$\delta(D, 0) = C$
$\delta(D, 1) = E$
$\delta(E, 0) = E$
$\delta(E, 1) = E$
Start state: A
Accept states: {A, D}

OR

5. Explain algebraic laws for regular expressions with example. [10M]

6. Explain why not all context-free languages can be accepted by a deterministic PDA. [10M]

OR

7. Explain what makes a PDA deterministic (DPDA). [10M]
Discuss the limitations and advantages of DPDAs compared to non-deterministic PDAs.

8. Convert the following CFG into Chomsky Normal Form: [10M]
$S \rightarrow AB|aS$,
$A \rightarrow BC|b$,
$B \rightarrow b$
$C \rightarrow c$

OR

9. Explain how Turing machines extend the capabilities of finite automata and pushdown automata. Discuss the concept of Turing-completeness. [10M]

10. Explain the concept of a Turing machine. What is the halting problem, and why is it significant in the context of computation theory? [10M]

OR

11. Explain why the word problem for groups is undecidable. Provide an example illustrating this problem. [10M]

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