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 School of Engineering Sciences and Technology
 Department of Computer Science & Engineering
 Odd Semester Examination –2022
 Subject: Formal Languages & Automata Theory

Paper Code: BTCSE 503/ BTCSEAI 503

TIME: 3 Hours

SECTION-A (35 Marks)

MAX. MARKS: 75

❖ Attempt ALL questions. Each question is of 5 marks.

Q. No.	Questions	CO*	BL
1.	Let $L = \{ab, aa, baa\}$. Which of the following strings are in L^* : abaabaaabaa, aaaabaaaa, baaaaabaaaab, baaaaabaa? Also find which strings are in L^4 ?	CO1	L1, L2
2.	What is Context free grammar? Generate CFG for the grammar the language $L = \{a^n b^n : n \geq 0\}$	CO3	L3, L6
3.	Find a DFA or NFA that accepts all the strings on $\{0, 1\}$, except those containing the substring 001.	CO3	L3, L5
4.	Convert the nfa defined by $\delta(q_0, a) = \{q_0, q_1\}$, $\delta(q_1, b) = \{q_1, q_2\}$, $\delta(q_2, a) = \{q_2\}$, $\delta(q_0, \lambda) = \{q_2\}$ with initial state q_0 and final state q_2 into an equivalent dfa.	CO2	L2, L3
5.	State pumping lemma for regular languages. Explain it with proper example.	CO1	L1, L2
6.	What language is accepted by the pda $M = (\{q_0, q_1, q_2, q_3, q_4, q_5\}, \{a, b\}, \{0, 1, z\}, \delta, q_0, z, \{q_5\})$, with $\delta(q_0, b, z) = \{(q_1, 1z)\}$, $\delta(q_1, b, 1) = \{(q_1, 11)\}$, $\delta(q_2, a, 1) = \{(q_3, \lambda)\}$, $\delta(q_3, a, 1) = \{(q_4, \lambda)\}$, $\delta(q_4, a, z) = \{(q_4, z), (q_5, z)\}$?	CO2	L2, L3
7.	Find regular expressions for the following languages on alphabet $\{a, b\}$ (a) $L = \{w : w \bmod 2 = 0\}$. (b) $L = \{w : w \text{ start and end with different alphabet}\}$. (c) $L = \{a^n b^m : (m+n) \text{ is odd}\}$. (d) $L = \{w : w \text{ has substring } ab\}$.	CO1	L1, L2

SECTION-B (40 Marks)

❖ Attempt FOUR questions. Each question is of 10 marks.

Q. No.	Questions	CO*	BL
1.	1. a) Differentiate between NFA and DFA. (3 Marks) b) For the given DFA find the minimized state finite automata accepting the same language. (7 Marks)	CO1	L1, L2, L3

2.	a) Define NPDA (Nondeterministic pushdown automata). Construct an NPDA for the following language $L = \{w \in \{a,b\}^* : n_a(w) = n_b(w)\}$. (10 Marks)	CO2	L1, L2, L3
3.	a) Define Turing Machine and its halt state in detail. (5 Marks) b) What language is accepted by the Turing machine whose transition graph is in the figure below? (5 Marks) <pre> graph LR q0((q0)) -- "a : a, R" --> q1((q1)) q1 -- "b : b, R" --> q0 q1 -- "a : a, R" --> q3(((q3))) q3 -- "b : b, R" --> q2((q2)) q2 -- "b : b, R" --> q0 q2 -- "a : a, R" --> q3 q1 -- "b : b, R" --> q1 q2 -- "a : a, R" --> q2 </pre>	CO3	L3, L6
4.	a) Define Chomsky normal form (CNF) for context free grammar. Reduce the following grammar to CNF : $S \rightarrow ABAC$ $A \rightarrow aA \mid \lambda$ $B \rightarrow bB \mid \lambda$ $C \rightarrow c$ b) What do you mean by <i>Ambiguous</i> context-free grammar? Explain with proper example. (5 Marks)	CO4	L3, L4, L5
5.	Draw DFAs for each of the following languages over the alphabet " $\Sigma = \{0,1\}$ ": a) All strings that end with 00. b) All strings that contain an even number of 1's. c) All strings which do not contain the substring 10. d) all string that start and end with same alphabet	CO5	L3, L5, L6
6.	Write short notes on any two of the following: a. Decidable problems b. Undecidable problems c. closure properties of Context free grammars. d. Chomsky's Classification of Grammar	CO2	L2, L3

CO*-CourseOutcomesfromSyllabus,BL*.-

Bloom's Taxonomy Levels (1: Remembering, 2: Understanding, 3: Applying, 4: Analyzing, 5: Evaluating, 6: Creating)

END