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Supplementary Examination – 2023
Subject: Formal Languages & Automata Theory
Paper Code: BTCSE 503/ BTCSEAI 503

TIME: 3 Hours

MAX. MARKS: 75

SECTION – A (35 Marks)

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

Q. No.	Questions	CO*	BL*
1.	Define DFA (deterministic finite automata) and its uses.	CO1	L1, L2
2.	What is Context free grammar? Generate CFG for the grammar the language $L = \{(ab)^n : n \geq 0\}$	CO3	L3, L6
3.	Find a DFA that accepts all the strings on $\{0, 1\}$, which start and end with 1.	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.	Consider the following grammar $S \rightarrow bB / aA$ $A \rightarrow b / bS / aAA$ $B \rightarrow a / aS / bBB$ For the string $w = bbaababa$, find- Leftmost derivation and Rightmost derivation	CO1	L1, L2
6.	Check whether the grammars G_1 and G_2 are ambiguous or not with proper explanation. G_1 : $S \rightarrow AB \mid aaB$ $A \rightarrow aA \mid \lambda$ $B \rightarrow bB \mid \lambda$ G_2 : $S \rightarrow A \mid B$ $A \rightarrow aAb \mid ab$ $B \rightarrow abB \mid \lambda$	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 (40Marks)

❖ Attempt any 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.	Define NPDA(Nondeterministic pushdown automata). Design the PDA for the language $L = \{a^n b^{2n} \mid n > 0\}$ (10 Marks)	CO2	L1, L2, L3
3.	a) Define Turing Machine and its halt state in detail. (3Marks) b) Convert the given CFG to the equivalent CNF: (7 Marks) $S \rightarrow AACD$ $A \rightarrow aAb \mid \epsilon$ $C \rightarrow aC \mid a$ $D \rightarrow aDa \mid bDb \mid \epsilon$	CO3	L3, L6
4.	State pumping lemma for regular languages. Using Pumping lemma prove that the language $L = \{(ab)^n a^k : n > k, k \geq 0\}$ is not regular	CO4	L3, L5
5.	Draw DFAs for each of the following languages over the alphabet "$\Sigma = \{0,1\}$": a) All strings that end with 01. 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 1.	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'sTaxonomyLevels(1:Remembering,2:Understanding,3:Applying, 4: Analyzing,5: Evaluating, 6:Creating)