

M.E. / M.Tech. / B.E. / B.Tech - DEGREE EXAMINATIONS, NOV / DEC 2025

Fifth Semester

Computer Science and Engineering

(Common to Computer Science and Engineering (IoT) and M.Tech.- Computer Science and Engineering
(5Years Integrated))

20CSPC502 - THEORY OF COMPUTATION

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. For specified input, there can be how many paths from the current state to the next state in DFA? (a) Many (b) None (c) One (d) Zero	1	K1	CO1
2. Suppose w= 110. So, what would be the length of a string? (a) 2 (b) 0 (c) 3 (d) 7	1	K1	CO1
3. Which type of expression can be used easily to represent the language accepted by finite automata? (a) Constant expression (b) Frequent expression (c) Regular expression (d) Conventional expression	1	K1	CO2
4. Which of the following regular expressions describes the language over {0, 1} consisting of strings that contain exactly two 1's? (a) 0 * 10 * 10 * (b) 0 * 110 * (c) (0 + 1) * 11(0 + 1) * (d) (0 + 1) * 1(0 + 1) * 1(0 + 1) *	1	K1	CO2
5. How does a Pushdown Automaton (PDA) use its memory structure to process input? (a) Queue (b) Stack (c) Array (d) Linked List	1	K1	CO3
6. Which CFG generates the language $L = \{a^n b^n \mid n \geq 0\}$? (a) $S \rightarrow aSb \mid ab$ (b) $S \rightarrow aSb \mid \epsilon$ (c) $S \rightarrow aS \mid Sb \mid ab$ (d) $S \rightarrow aSbb \mid \epsilon$	1	K1	CO3
7. Which of the following is not a closure property of CFLs? (a) Union (b) Concatenation (c) Intersection (d) Kleene star	1	K1	CO4
8. A multi track turing machine can described as a 6-tuple (Q, X, S,d, q0, F) where X represents: (a) input alphabet (b) tape alphabet (c) shift symbols (d) Machine Symbol	1	K1	CO4
9. In a n-track turing machine, how many head/heads read and write on all tracks simultaneously. (a) one (b) two (c) n (d) infinite	1	K1	CO5
10. The class NP represents _____. (a) Problems verifiable in polynomial time (b) Problems not solvable (c) Regular languages (d) Context-free languages	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

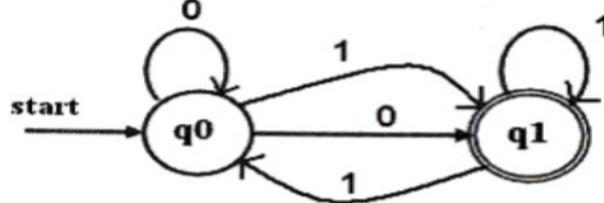
11. Differentiate between proof by contradiction and proof by contrapositive.	2	K2	CO1
12. Identify DFA for the set of all strings with equal number of 0's and 1's starting with '0'.	2	K2	CO1
13. Describe the Steps in Pumping Lemma.	2	K2	CO2
14. Illustrate a finite automata for the Regular expression 0*1*.	2	K2	CO2
15. Explain parse tree and derivation with suitable examples.	2	K2	CO3
16. What are Instantaneous Descriptions (ID) in PDA?	2	K1	CO3

17. Examine and eliminate the Useless Symbols in the following Grammar G 2 K2 CO4
 $S \rightarrow CD$
 $C \rightarrow c CC / \epsilon$
 $D \rightarrow d DD / \epsilon$
18. Show when is a function f said to be Turing computable. 2 K2 CO4
19. Differentiate Multitape and Multi-track Turing Machine. 2 K2 CO5
20. Classify the techniques for Turing machine construction. 2 K2 CO5
21. Prove that the Ambiguity Problem for Context-Free Grammars is undecidable. 2 K2 CO6
22. Compare PCP or Post Correspondence Problem. 2 K2 CO6

PART - C (6 × 11 = 66 Marks)

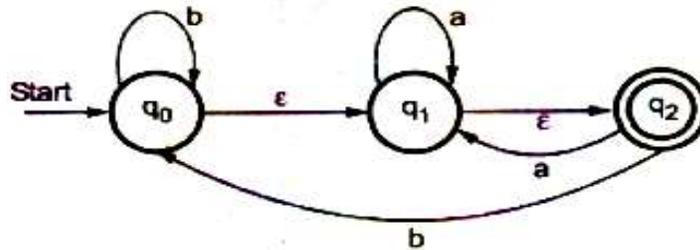
Answer ALL Questions

23. a) Convert the following NFA to a DFA using the subset construction algorithm. 11 K3 CO1

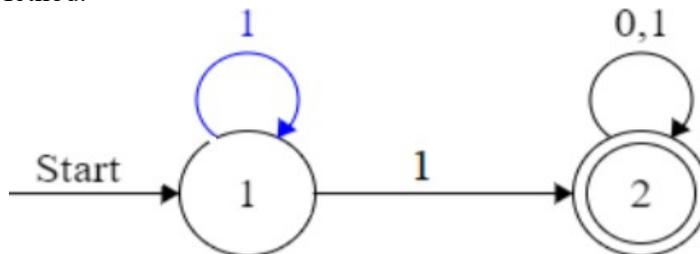


OR

- b) Convert the following NFA with epsilon to its equivalent DFA directly. 11 K3 CO1



24. a) Determine a regular expression by converting the Finite Automata using the Formula Method. 11 K3 CO2



OR

- b) Show that the language $L = \{0^n 1^n \mid n \geq 1\}$ is not a regular Language using Pumping Lemma. 11 K3 CO2

25. a) Consider the grammar G 11 K3 CO3

$S \rightarrow A1B$

$A \rightarrow 0A \mid \epsilon$

$B \rightarrow 0B \mid 1B \mid \epsilon$

Interpret the strings

(i) 00101

(ii) 1001

(iii) 00011 using leftmost and rightmost derivation and parse trees.

OR

b) Construct PDA to accept the language $L = \{a^{n+1} b^{2n} / n \geq 1\}$ by empty stack and convert this PDA by reaching Final State. 11 K3 CO3

26. a) Determine a Chomsky normal form by Interpreting the following grammar by eliminating null productions, unit production and useless symbols. 11 K3 CO4

$S \rightarrow aA \mid aBB$
 $A \rightarrow aaA \mid \epsilon$
 $B \rightarrow bB \mid bbC$
 $C \rightarrow B$

OR

b) Identify Greibach Normal Form (GNF) for the following grammar. 11 K3 CO4

$S \rightarrow AB$
 $A \rightarrow BS \mid b$
 $B \rightarrow SA \mid a$

27. a) Construct the TM for Multiplication of two numbers using copy subroutine. 11 K3 CO5

OR

b) Describe with an example and list the various programming techniques of Turing machine construction in detail. 11 K3 CO5

28. a) Identify the code of the Turing machine $M = (\{q_1, q_2, q_3\}, \{0, 1\}, \{0, 1, B\}, \delta, q_1, B, \{q_2\})$. The Transition functions of the turing machine are as follows

$\delta(q_1, 1) = (q_3, 0, R)$
 $\delta(q_3, 0) = (q_1, 1, R)$
 $\delta(q_3, 1) = (q_2, 0, R)$
 $\delta(q_3, B) = (q_3, 1, L)$

OR

b) (i) Describe about Recursive and Recursive Enumerable languages with an example 5 K3 CO6

(ii) Identify that "MPCP reduce to PCP". Does PCP with two lists below have a solution. 6 K3 CO6

i	List A (W_i)	List B (X_i)
1	1	111
2	10111	10
3	10	0