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Question Paper Code	13285
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024**

Third Semester

**Computer Science and Business Systems**

**20CBPC301 - FORMAL LANGUAGE AND AUTOMATA THEORY**

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (20 × 1 = 20 Marks)**

Answer ALL Questions

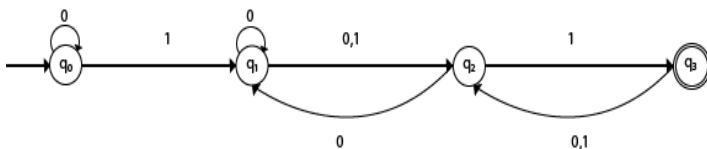
	<i>Marks</i>	<i>K – Level</i>	<i>CO</i>
1. What is the symbol for Empty string? (a) $\epsilon$ (b) $\Phi$ (c) $\Sigma$ (d) $\sigma$	1	K1	CO1
2. “CFG” stands for _____ (a) Context Free Graph                      (b) Context Free Grammar (c) Context Finite Graph                      (d) Context Finite Grammar	1	K1	CO1
3. Which of the following is true? (a) Every subset of a regular set is regular (b) Every finite subset of non-regular set is regular (c) The union of two non-regular set is not regular (d) Infinite union of finite set is regular	1	K1	CO1
4. Regular Expression R and the language it describes can be represented as: (a) R, R(L)                      (b) L(R), R(L)                      (c) R, L(R)                      (d) All of the mentioned	1	K1	CO1
5. Complete the Tuples (Q, $\Sigma$ ,q <sub>0</sub> ,F, ____ (a) $\delta$ (b) $\sigma$ (c) $\nabla$ (d) None of the above	1	K1	CO2
6. What does the language of a Deterministic Finite Automaton (DFA) represent? (a) Set of all possible inputs                      (b) Set of accepted strings (c) Set of transitions                      (d) Set of initial states	1	K1	CO2
7. The set of strings that a DFA recognizes is known as the _____. (a) Input alphabet                      (b) Transition set                      (c) Accepted language                      (d) Final state set	1	K1	CO2
8. Complement of a DFA can be obtained by (a) making starting state as final state                      (b) no trivial method (c) making final states non-final and non-final to final                      (d) make final as a starting state	1	K1	CO2
9. The language accepted by Push down Automaton: (a) Recursive Language                      (b) Context free language (c) Linearly Bounded language                      (d) All of the mentioned	1	K1	CO3
10. What is the pumping length of string of length x? (a) x+1                      (b) x                      (c) x-1                      (d) x2	1	K1	CO3
11. Which of the following does not obey pumping lemma for context free languages? (a) Finite languages                      (b) Context free languages (c) Unrestricted languages                      (d) None of the mentioned	1	K1	CO3
12. Context free languages are not closed under: (a) Intersection                      (b) Intersection with Regular Language (c) Complement                      (d) All of the mentioned	1	K1	CO3
13. Which type of languages can be recognized by computational models equivalent to Turing machines? (a) Regular languages                      (b) Context-free languages (c) Recursively enumerable languages                      (d) Non-context-sensitive languages	1	K1	CO4
14. What computational concept do nondeterministic Turing machines help model? (a) Parallelism                      (b) Randomization                      (c) Determinism                      (d) Recursion	1	K1	CO4

15. Which of the following statements about nondeterministic Turing machines is true? 1 K1 CO4  
 (a) They always halt within a finite time  
 (b) They always produce deterministic output  
 (c) They are equivalent to finite automata  
 (d) They can solve NP-complete problems
16. Why Turing machine is very powerful than Finite automata? 1 K1 CO4  
 (a) Turing machine head movement is continued to one direction.  
 (b) Turing machine head moment is in both directions  
 (c) Turing machine has capability to remember arbitrary long sequence of input string.  
 (d) All of the mentioned
17. What does it mean for a problem to be undecidable? 1 K1 CO5  
 (a) It can be solved with a finite amount of resources  
 (b) It has only one possible solution  
 (c) It has no solution within a specific framework  
 (d) It has a unique solution that can be found in polynomial time
18. Halting problem is an example for \_\_\_\_\_. 1 K1 CO5  
 (a) decidable problem (b) undecidable problem  
 (c) complete problem (d) trackable problem
19. The concept of \_\_\_\_\_ is used to denote a class of decision problems that are at least as hard as the hardest problems in the complexity class NP. 1 K1 CO5  
 (a) P (b) PSPACE (c) NP-complete (d) NP-hard
20. Diagonalization can be useful in \_\_\_\_\_. 1 K1 CO5  
 (a) To find a non-recursively enumerable language  
 (b) To prove undecidability of halting problem  
 (c) To find a non-recursively enumerable language & also proves undecidability of halting problem  
 (d) None of the mentioned

**PART - B (10 × 2 = 20 Marks)**

Answer ALL Questions

21. Define Finite Automata. 2 K1 CO1
22. List the operators of Regular Expressions. 2 K1 CO1
23. Compare NFA with DFA. 2 K2 CO2
24. 2 K2 CO2



Show the transition table for the given diagram.

25. When do you say a grammar is ambiguous? 2 K1 CO3
26. List out the rules to convert CFG to GNF. 2 K1 CO3
27. Show Turing machines as enumerators. 2 K2 CO4
28. What are the applications of Turing Machine? 2 K1 CO4
29. Define Rice theorem. 2 K1 CO5
30. What is universal Language Lu? 2 K1 CO5

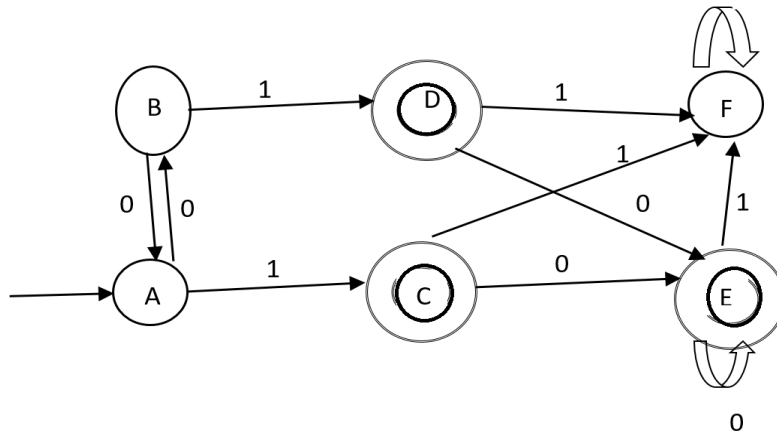
**PART - C (6 × 10 = 60 Marks)**

Answer ALL Questions

31. a) Explain in detail about Chomsky Hierarchy Model. 10 K2 CO1  
 OR  
 b) Summarize productions and derivations in detail. 10 K2 CO1

32. a) Make use of the Myhill-Nerode Theorem to minimize the following DFA.

10 K3 CO2



**OR**

b) Solve the language  $A = \{a^n b^n \mid n \geq 0\}$  using Pumping Lemma and prove that language A is not regular. 10 K3 CO2

33. a) Show the PDA for language  $L = \{wcw^R \mid w = \{0, 1\}^*\}$  where  $w^R$  is the reverse of  $w$ . 10 K2 CO3

**OR**

b) Explain the working of Linear Bounded Automata with example. 10 K2 CO3

34. a) Construct a Turing Machine to accept the language  $L = \{a^n b^n \mid n > 1\}$ . Draw the transition diagram. Also specify the instantaneous description to trace the string aabb. 10 K3 CO4

**OR**

b) Develop a Turing Machine which recognizes the language  $L = 01^*0$ . Draw Turing Machine, Transition steps and Tape sequence. 10 K3 CO4

35. a) Illustrate undecidability of PCP in detail. 10 K2 CO5

**OR**

b) Explain in detail about Universal Turing Machine. 10 K2 CO5

36. a) Rephrase the following grammar to Greibach Normal Form 10 K2 CO3

$$S \rightarrow ABA \mid AB \mid BA \mid AA \mid B$$

$$A \rightarrow aA \mid a$$

$$B \rightarrow bB \mid b$$

**OR**

b) Describe how you remove ambiguity in Grammar. Explain with example. 10 K2 CO3