B.Tech/ M.Tech (Integrated) DEGREE EXAMINATION, MAY 2024
Fifth Semester

21CSC301T – FORMAL LANGUAGE AND AUTOMATA
(For the candidates admitted from the academic year 2022-2023 onwards)

Note:
(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours

Max. Marks: 75

PART – A (20 × 1 = 20Marks)
Answer **ALL** Questions

		Marks	BL	CO

1. Automata that can be used to develop a learning model and is involved in decision making — 1 1 1
   (A) Push down automata
   (B) Linear bounded automata
   (C) Finite automata
   (D) Discrete automata

2. If the number of states in NFA is N, then DFA can have maximum of — 1 2 1
   (A) 2^N states
   (B) N/2 states
   (C) 2N states
   (D) N states

3. A language is regular if and only if — 1 2 1
   (A) accepted by DFA
   (B) accepted by PDA
   (C) accepted by LBA
   (D) accepted by Turing machine

4. Which of the following is not an example of finite state machine system — 1 1 1
   (A) Elevator mechanism
   (B) Combination locks
   (C) Traffic lights
   (D) Digital watches

5. In the formal definition of CFG where G=(V, E, p, S), S represents — 1 1 2
   (A) Accepting State
   (B) Starting Variable
   (C) Sensitive Grammar
   (D) Starting state

6. A grammar with n parse trees where n>1 is called — 1 1 2
   (A) Unambiguous
   (B) Ambiguous
   (C) Regular
   (D) Recursive

7. Which of the following is not a grammar simplification procedure? — 1 1 2
   (A) Removal of epsilon productions
   (B) Removal of unit productions
   (C) Removal of useless symbols
   (D) Removal of non-reachable states

8. Which of the following is an CNF? — 1 1 2
   (A) A->Aw
   (B) A->x
   (C) A>xw
   (D) A->Xw

9. The data structure used in processing the characters of the string in PDA is   1   1   3
   - (A) Stack
   - (B) Queue
   - (C) List
   - (D) Array

10. Identify the most appropriate Language accepted by DPDA is _____.   1   2   3
    - (A) Regular Expression
    - (B) Context free language
    - (C) Recursively enumerable
    - (D) Regular grammar

11. An attempt to reduce the input string to the start symbol of a grammar is called _____.   1   1   3
    - (A) Top-down parsing
    - (B) Bottom-up parsing
    - (C) Syntactic parsing
    - (D) Hybrid parsing

12. Which of the following is not a property of CFL   1   2   3
    - (A) Kleene closure
    - (B) Homomorphism
    - (C) Intersection
    - (D) Concatenation

13. Which of the following can accept even palindrome over {a,b}   1   2   4
    - (A) Deterministic
    - (B) Turing machine
    - (C) NDFA
    - (D) Linear bounded automata

14. A turing machine has _____.   1   1   4
    - (A) Finite memory
    - (B) Infinite memory
    - (C) No memory
    - (D) Stack memory

15. Type 0 languages are called _____.   1   1   4
    - (A) Recursive Enumerable (RE)
    - (B) Regular expressions
    - (C) Context free language
    - (D) Context free grammar

16. In a 6-tuple TM defined by (Q, X, E, 5, CIO, F), X represents   1   1   4
    - (A) Tape alphabet
    - (B) Stack symbol
    - (C) Initial state
    - (D) Final state

17. A problem that can be validated in polynomial time is called _____.   1   2   5
    - (A) NP problem
    - (B) P problem
    - (C) PCP problem
    - (D) None of the above

18. Post Correspondence problem is _____.   1   1   5
    - (A) decidable decision problem
    - (B) undecidable decision problem
    - (C) not a decision problem
    - (D) NP problem

19. The problems in NP class has _____.   1   1   5
    - (A) Deterministic algorithm
    - (B) Non deterministic polynomial algorithm
    - (C) Non polynomial algorithm
    - (D) No solution

20. Subset sum problem is an ideal example of _____.   1   2   5
    - (A) P
    - (B) NP
    - (C) NP-hard
    - (D) Undecidable

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Answer **ALL** Questions

		Marks	BL	CO	PO

21. a. Construct a DFA that accepts odd number of I 's and even number of 0's. **8 3 1**

(OR)

b. Convert the Regular expression into Epsilon-NFA for the string $10+(0+11)0^*1$. **8 3 1**

22. a. Simplify the given grammar G: **8 3 2**

   S->aA/a/C
   A->aB/ϵ
   B->aA
   C->cCD

(OR)

b. Find leftmost, rightmost derivations and parse tree for w=+*-xyxy for the production rule given below $E->+EE \mid *EE \mid -EE \mid x \mid y$. **8 3 2**

23. a. Design a PDA to accept $L = \{a^n b^m c^m dhn \mid m,n = 1\}$. **8 3 3**

(OR)

b. Construct a PDA to accept $L = \{ww^R, w \in \{a,b\}\}$. **8 3 3**

24. a. Prove that Union of two recursive languages is recursive. Also discuss the complement property. **8 4 4**

(OR)

b. Construct a TM that accepts strings with "aba" as a substring on the input $\Sigma = \{a,b\}$. **8 4 4**

25. a. Write short notes on NP hard and NP Complete. Express the relationship among them. **8 2 5**

(OR)

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b. Let = {0, 1}. Let A & B be strings. Find the instance of PCP.

S. No	List A (w$_i$)	List B (X$_i$)
1	1	111
2	10111	10
3	10	

PART – C (1 × 15 = 15 Marks)
Answer **ANY ONE** Question

		Marks	BL	CO	PO

26. Obtain the code for <M, 1011> such that M [{qo, q, q2, q3, q4}), {0, 1}, {O,I,X,Y,B}, 5, qo B, {q4}] where ö is **15 3 5**

$\delta (q_0, 0) = (q_1, X, R)$
$\delta (q_0, y) = (q_3, Y, R)$
$\delta (q_1, 0) = (q_1, 0, R)$
$\delta (q_1, 1) = (q_2, Y, L)$
$\delta (q_1, Y) = (q_1, Y, R)$
$ö (q2, 0) = (q2, 0, L)$
$\delta (q_2, X) = (q_0, X, R)$
$\delta (q_2, Y) = (q_2, Y, L)$
$\delta (q_3, Y) = (q_3, Y, R)$
$\delta (q_3, R) = (q_4, B, R)$

Also design a TM which adds two numbers.

27. Construct a turing machine that accepts all palindromes over $\{0, 1\}$.   15   4   4

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