29. a. Explain the DFA Minimization algorithm with an example. 12 3 2

(OR)

b. Solve the following grammar
S-->aAa | bBb | BB
A--> C
B--> S | A
C -->S | ε for the string "abaaba", find
(i) Left most derivation [4 Marks]
(ii) Right most derivation [4 Marks]
(iii) Derivation Tree [4 Marks]

30. a. Give pushdown automata that recognize the following languages. Give both a drawing and 6-tuple specification for each PDA. 12 5 3
A = { w ∈ {0, 1} * | w contains at least three 1s}

(OR)

b. Convert the given CFG to CNF
S → ASB
A → aAS|a|ε
B → SbS|A|bb

31. a. Construct a TM for the language {w w^R | w ∈ {0, 1} * }. Note : w^R is a reverse of w. 12 3 4

(OR)

b. (i) Explain Multi tape and Multi head Turing machine with suitable example [6 Marks]
(ii) Compare the difference between recursive and recursively enumerable languages [6 Marks]

32. a. (i) Plan and explain on decidable and un-decidable problems with an example [6 Marks] 12 2 5
(ii) Design and prove that for two recursive languages L1 and L2 their union and intersection is recursive. [6 Marks]

(OR)

b. (i) Describe post correspondence problem.[6 Marks]
(ii) Compare and write about tractable and untractactable problems with an example. [6 Marks]

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Reg. No

B.Tech. DEGREE EXAMINATION, JUNE 2023

Third Semester

18CSC261T - FORMAL LANGUAGE AND AUTOMATA THEORY

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

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 40 minutes.
ii. **Part - B** and **Part - C** should be answered in answer booklet.

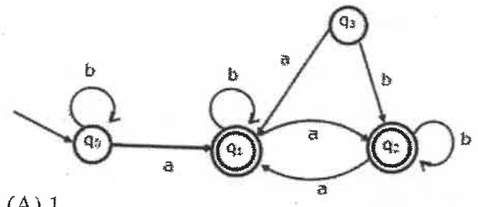
Time: 3 Hours **Max. Marks: 100**

Part - A (20 × 1 Marks = 20 Marks) Marks BL CO
Answer **All** Questions

1. A Language for which no DFA exist is a _____ 1 1 1
(A) Regular Language (B) Non-Regular Language
(C) May be Regular (D) Cannot be said

2. When are 2 finite states equivalent? 1 1 1
(A) Same number of transitions (B) Same number of states
(C) Same number of states as well as transitions (D) Both are final states

3. The minimum state automation equivalent to the below FSA has the following number of states? 1 2 1



(A) 1 (B) 2
(C) 3 (D) 4

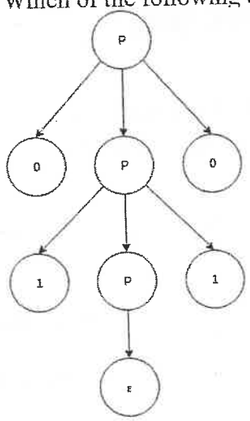
4. While applying Pumping lemma over a language, we consider a string w that belong to L and fragment it into _____ parts. 1 2 1
(A) 2 (B) 5
(C) 3 (D) 6

5. Which among the following cannot be accepted by a regular grammar? 1 2 2
(A) L is a set of numbers divisible by 2 (B) L is a set of binary complement
(C) L is a set of string with odd number of 0 (D) L is a set of 0^n1^n

6. Which among the following is the root of the parse tree? 1 1 2
(A) Production P (B) Starting Variable S
(C) Variable V (D) Terminal T

7. Production Rule: aAb->agb belongs to which of the following category? 1 1 2
(A) Regular Language (B) Context free Language
(C) Context Sensitive Language (D) Recursively Enumerable Language

8. Which of the following does the given parse tree correspond to? 1 2 2



(A) P->1100
(B) P->0110
(C) P->1100ε
(D) P->0101

9. abb*c denotes which of the following? 1 3 3
(A) {ab^nc|n=0}
(B) {ab^nc|n=1}
(C) {a^nbc|n=0}
(D) {abc^n|n>0}

10. Given Grammar: 1 2 3
S->A,
A->aA,
A->Ɛ ,
B->bA
Which among the following productions are Useless productions?
(A) S->A
(B) A->aA
(C) A->Ɛ
(D) B->bA

11. Let G=(V, T, P, S) be a CFG such that _____. Then there exists an equivalent grammar G' having no Ɛ productions. 1 1 3
(A) e ∈ L(G)
(B) w ∉ L(G)
(C) e ∉ L(G)
(D) w ∈ L(G)

12. Which of the following statement is false? 1 1 3
(A) Context free language is the subset of context sensitive language
(B) Regular language is the subset of context sensitive language
(C) Recursively enumerable language is the super set of regular language
(D) Context sensitive language is a subset of context free language

13. A language L is said to be Turing decidable if: 1 2 4
(A) It is recursive
(B) TM recognizes L
(C) TM accepts L
(D) It is recursive & TM recognizes L

14. The value of n if turing machine is defined using n-tuples: 1 1 4
(A) 6
(B) 7
(C) 8
(D) 9

15. In a n-track turing machine, _____ head/heads read and write on all tracks simultaneously. 1 2 4
(A) 1
(B) 2
(C) n
(D) infinite

16. Which among the following are undecidable theories? 1 1 4
(A) The first order theory of boolean algebra
(B) The first order theory of Euclidean geomentry
(C) The first order theory of hyperbolic geometry
(D) The first order theory of the natural number with addition, multiplication, and equality

17. Post Correspondence problem is 1 2 5
(A) decidable decision problem
(B) undecidable decision problem
(C) not a decision problem
(D) Recursive

18. Consider three decision problem A, B, C. A is decidable and B is not. Which of the following is a correct option? 1 2 5
(A) C is undecidable if C is reducible to B
(B) C is undecidable if B is reducible to C
(C) C is decidable if A is reducible to C
(D) C is decidable if C is reducible to B's complement.

19. The complexity class P consist of all the decision problems that can be solved by _____using polynomial amount of computation time. 1 1 5
(A) Push Down automata
(B) DFA
(C) NDFA
(D) Deterministic Turing machine

20. Traveling sales man problem belongs to which of the class? 1 2 5
(A) P problem
(B) NP problem
(C) Linear problem
(D) Non Linear problem

Part - B (5 × 4 Marks = 20 Marks) Marks BL CO
Answer **any 5** Questions

21. Construct DFA for the language accepting strings starting with '101'. 4 3 1

22. Construct a DFA for the regular expression aa*bb*. 4 3 2

23. Examine the string aaabbabbba for the Grammar G with 4 4 3
S-->aB|bA
A -->a|aS|bAA
B -->b|bS|aBB

24. Give a CFG for the language of palindrome string over {a,b}.Write the CFG for the language ,L=($a^n b^n | n \geq n$). 4 3 3

25. Explain the special features of TM? Define universal TM. Define Instantaneous description of TM. 4 2 4

26. Compare and contrast recursive and recursively enumerable languages. 4 2 4

27. State when a problem is said to be decidable and give an example of an undecidable problem. 4 1 5

Part - C (5 × 12 Marks = 60 Marks) Marks BL CO
Answer **All** Questions

28. a. Given ∑ ={a,b} Analyze and construct a DFA which recognize the language L= {b^m a b^n: m,n>0} 12 3 1

(OR)

b. Construct the following ε-NFA to DFA.

states	ε	a	b	c
--> p	Φ	{p}	{q}	{r}
q	{p}	{q}	{r}	{p,q}
*r	{q}	{r}	ϕ	Φ