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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022
COMPUTER SCIENCE AND ENGINEERING
(2020 SCHEME)

Course Code : 20CST301

Course Name: Formal Languages and Automata Theory

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Differentiate DFA and NFA.
2. Define regular grammar with example.
3. What is Kleene closure and positive closure? Give suitable examples for both Kleene closure and positive closure.
4. Construct regular expression for the language over the alphabet {0,1}* generates strings which contains 00 or 11 as substring.
5. When a grammar is said to be ambiguous? Explain with a suitable example.
6. What do you mean by null production and unit production? Give an example.
7. Define PDA.
8. Explain main applications of pumping Lemma in CFL's.
9. List out the different techniques for Turing Machine construction.
10. When a language is said to be recursively enumerable?

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. Convert the following ε-NFA to equivalent DFA

	ε	a	b	c
→ p	Φ	{p}	{q}	{r}
q	{p}	{q}	{r}	Φ
*r	{q}	{r}	Φ	{p}

(14)

OR

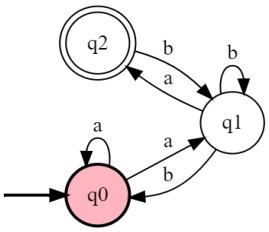
12. a) Construct a DFA that accepts even number of 0's and even number of 1's. (6)

    b) Design a NFA accepts the set of all strings over {0,1}* begin with 01 and ends with 11. Check for the validity of the string 011111. (8)

MODULE II

13. a) Show that $L=\{a^n b^n \mid n>0\}$ is not regular (7)

b) Generate the equivalent regular expression for the following NFA (7)



OR

14. a) Construct the finite automata for the following regular expressions:
    i) (1+0)*11
    ii) (1*0*)* (10)

b) What are the necessary conditions for regular languages? (4)

MODULE III

15. a) Construct the CFG for the language $L=\{a^n b^{2n} \mid n>=1\}$. (4)

b) Minimize the following DFA M=({A,B,C,D,E},{0,1},δ,A,{E}) using Myhill Nerode Theorem. (10)

	0	1
->A	B	C
B	B	D
C	B	C
D	B	E
*E	B	E

OR

16. What is the purpose of normalization? Construct the CNF and GNF for the following grammar and explain the steps. (14)

S→aAa | bBb | ε
A→C|a
B→C|b
C→CDE | ε
D→A|B|ab

MODULE IV

17. a) Construct the PDA accepting the language $L=\{ww^R \mid w \text{ is in } (a+b)^*\}$. Trace your PDA for a sample string. (10)

b) What are the different types of language acceptances by a PDA? Define them. Is it true that the language accepted by a PDA by these different types provides different languages? (4)

OR

18. a) Prove that CFLs are closed under Union, Concatenation and Homomorphism. (6)

b) Find the PDA equivalent to the given CFG with the following productions. (8)

S → A , A→BC, B→ba, C→ac.

MODULE V

19. a) Design a Turing Machine for the language L={$1^n0^n1^n$ |n>=1}. (10)

b) Write short note on Chomsky hierarchy of languages. (4)

OR

20. a) State halting problem. Prove that the halting problem of Turing Machine over {0,1)* as unsolvable. (10)

b) Prove that if L_1 and L_2 are Recursively Enumerable language over Σ, then $L_1 \cap L_2$ also Recursively Enumerable. (4)

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