Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARAY 2024
COMPUTER SCIENCE AND ENGINEERING
(2020 SCHEME)

Course Code : 20CST301

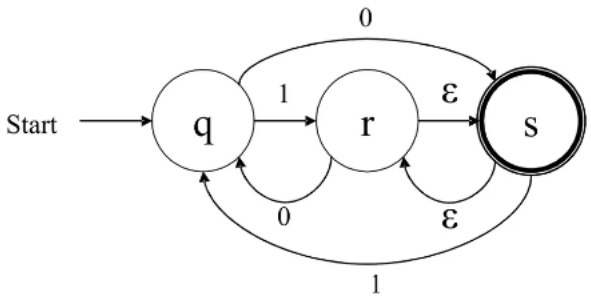
Course Name: Formal Languages and Automata Theory

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Describe the formal definitions of DFA and NFA.
2. Define ε - closure. Find ε - closure for all the states in the given diagram



3. Describe the regular language generated by regular expression (0+1)*001(0+1)*
4. Write regular expression for (i) String of a's and b's of even length. (ii) Set of strings consisting of even number of a's followed by odd number of b's
5. Construct Derivation Tree for the following grammar with respect to the string aaabbabbba.
   S→aB | bA
   A→aS| bAA|a
   B→ bS | aBB | b
6. State the Applications of Myhill-Nerode Theorem.
7. Prove that CFLs are closed under Union.
8. Construct the PDA from the CFG
   S → asa
   S → bsb
   S → ε
9. List types of Turing Machines.
10. Differentiate recursive languages and recursively enumerable languages.

PART B

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

MODULE I

11. a) Design a DFA that accepts odd number of 0's and odd number of 1's over the alphabet {0,1}*. Test whether the string 001011 is accepted by the above DFA. Show the entire sequence of states traversed. (10)

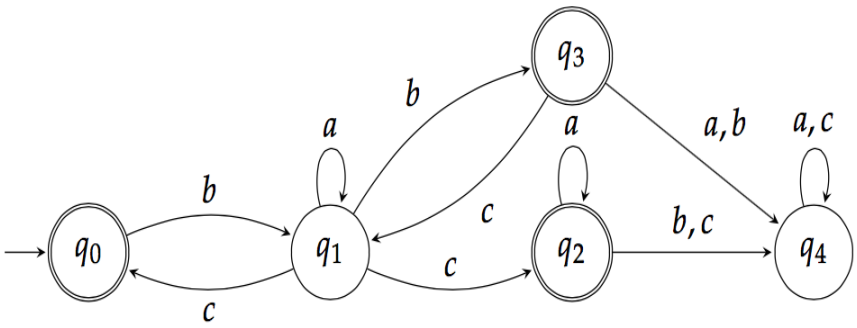
b) Design Finite automata for an identifier. Write regular expression corresponding to identifier. (4)

OR

12. a) Construct NFA for (0 + 1)*(00 + 11)(0 + 1)* and Convert to DFA. (14)

MODULE II

13. a) Convert the given Finite Automata to Regular Expression



(14)

OR

14. a) Using Pumping lemma test prove that the language L={a^n|n is a prime number} is not regular. (7)

b) Minimize the following DFA.

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

(7)

MODULE III

15. a) Provide proof of correctness for the following context free grammar.
G=({X},{a,b},P,X)
P:
X→XaXaXbX|XaXbXaX|XbXaXaX|ε (14)

OR

16. a) What is an ambiguous grammar? Prove that the Grammar G =({ S }, {a.b }, S,S →aSb |bSa | SS |∈} is ambiguous. (6)

b) Define Chomsky's normal form? Convert following grammar G into CNF where G = ({ S,A,B,D}, {a,b,d} , P,S}) (8)

P:

S→ aAD

A→ aB | bAB

B → b

D → d

MODULE IV

17. a) Construct a Context Free Grammar from the Push Down Automata

Where A= ({ q0, q1 }, {a,b} , [z0,z}, δ, q0, z0, ∅}

δ : δ (q0, b, z0) = (q0, zz0)

δ (q0, b, z) = (q0, zz)

δ (q1, b, z) = (q1, ∈)

δ (q0, ∈, z0) = (q0, ∈)

δ (q0, *a*, z) = (q1, *z*)

δ (q1, *a*, z0) = (q0, z0) (7)

b) Prove L = { a^i b^i c^i | i ≥ 1} is not context free language using Pumping Lemma. (7)

OR

18. a) Design a PDA where L={$a^n b^n$ |n>=1}U{$a^n b^{2n}$|n>=1} (10)

b) Differentiate PDA and NPDA (4)

MODULE V

19. a) Construct a Turing Machine to accept the language L= { ww^R | w ∈ (a + b) *} (10)

b) Write a context sensitive grammar for the language *L* = {$a^n b^n c^n$ |n ≥ 0}. (4)

OR

20. a) Prove that halting problem is undecidable (6)

b) Explain the Chomsky Hierarchy with a neat diagram. (8)

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