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Reg. No. : | | | | | | | | | | |

Question Paper Code: 95504

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Fifth Semester

Computer Science Engineering

19UCS504 – THEORY OF COMPUTATION

(Regulation 2019)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. Let L be a set accepted by a nondeterministic finite automaton. The number of states in non-deterministic finite automaton is |Q|. The maximum number of states in equivalent finite automaton that accepts L is…….. CO1- R

   (a) |Q| (b) 2|Q| (c) 2 raise to power |Q| (d) 4|Q|

2. Regular expression Φ* is equivalent to…….. CO1- R

   (a) ϵ (b) Φ (c) 0 (d) 1

3. Given the following Context-Free Grammar (CFG), G = ({S, T}, {(,), a, b}, S, P) with productions P: CO1- R

   S -> (T) | a

   T ->(S) | b Which of the following are in the language of G (i.e. are elements of L(G))?

   (a) ((a)) (b) (b)) (c) a(b) (d) b

4. The push down automata indicate the acceptance of input string in terms of CO1- R

   (a) Final state (b) Empty Stack (c) Both (a) and (b) (d) None of the mentioned

5. TM is a mathematical model of ---------- CO1- R

   (a) Calculator (b) Computer (c) Compiler (d) Interpreter

PART – B (5 x 3= 15 Marks)

6. Construct a finite automata for the language L= { 0^n / n mod 3 = 2,n ≥0} CO4- App

7. Write RE for CO1- R

(i) All strings beginning with '11 ' and ending with 'ab'

(ii) Set of all strings that end with '1'and has no substring '00'

(ii)Set of all strings over {0,1}with 3 consecutive 1's.

8. Find the language of the grammar S->aSb | aAb , A->bAa , A->ba. CO5- Ana

9. Define ID of PDA. CO1- R

10. Design a TM for Zero function. CO4- App

PART – C (5 x 16= 80Marks)

11. (a) (i) Design a DFA to accept strings of a's and b's having even no of a's and odd no of b's and to check whether the string w1=abaa is accepted or not**.** CO4-App (6)

(ii) Construct the equivalent DFA for the following NFA. CO2-App (10)

	0	1
->p	{p,q}	{p}
q	{r,s}	{t}
r	{p,r}	{t}
*s	ϕ	ϕ
*t	ϕ	ϕ

Or

(b) (i) Convert the following ε-NFA to it's equivalent DFA CO2- App (12)

	ε	0	1	2
->q_0	{q_1}	{q_0}	ϕ	ϕ
q_1	{q_2}	ϕ	{q_1}	ϕ
*q_2	ϕ	ϕ	ϕ	{q_2}

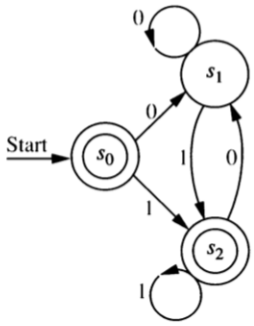
(ii) Construct NFA with ε, that end with string 11 for the set of all Strings {0,1} CO4-App (4)

12. (a) (i) Verify the following languages are regular or not using Pumping lemma. CO2-App (8)

(a) L={ 0^n1^n / n>=0}

(b) L={ WW^R / W is in {a,b}* }.

(ii) Construct a regular grammar that generates the language accepted by this finite state automaton. CO5-Ana (8)



Or

(b) Find the minimized DFA for the following regular expression (a/b)* abb. CO2- App (16)

13. (a) (i) Consider the following productions: CO2- App (8)

S ->aB | bA
A->aS | bAA | a
B->bS | aBB | b.

For the string aaabbabbba, find a leftmost derivation, rightmost derivation and draw derivation tree.

(ii) Show that the grammar S->a | abSb | aAb, ,A->bS | aAAb is ambiguous**.** CO5-Ana (8)

Or

(b) (i) Convert the Grammar G= ({ A1, A2, A3}, {a,b}, P, A1} into Greibach Normal Form, where P consists of the following: CO2- App (10)

A1->A2A3,
A2->A3A1 | b,
A3->A1A2 | a.

(ii) Find a Grammar in Chomsky Normal Form equivalent to CO2- App (6)
S-> aAbB;
A ->aA | a; B->bB|b**.**

14. (a) (i) Construct a PDA for the language L={$a^m b^m$| m >=0} CO4- App (8)

(ii) Construct a PDA for the given grammar and check the validation of "**010"** CO5-Ana (8)

S -> A1B
A -> 0A | ε
B -> 0B | 1B | ε

Or

(b) (i) Convert the PDA M=({q0,q1},{0,1},{X,Z0}, δ, q0,Z0,Φ) into Grammar. Where δ is defined as — CO5-Ana (8)

a. δ(q0,0,Z0) = (q1,XZ0)
b. δ(q0,0,X)=(q1,XX)
c. δ(q0,1,X) = (q1, ε)
d. δ(q1,1,X) = (q1, ε)
e. δ(q1, ε, X) = (q1, ε)
f. δ(q1, ε, Z0) = (q1, ε)

(ii) Prove that "If L is a context-sensitive language, then L is accepted by a linear bounded automaton". — CO5-Ana (8)

15. (a) Design a Turing Machine M for f(x,y)= x*y and x,y are stored in the tape in the form o^x1o^y1. — CO4- App (16)

Or

(b) Construct a TM to perform reverse operation. — CO4- App (16)