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Question Paper Code: 45204

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fifth Semester

Computer Science and Engineering

14UCS504 – THEORY OF COMPUTATION

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. A language L is accepted by the Finite Automata if and only if it is

   (a) Context-free (b) context-sensitive (c) recursive (d) right-linear

2. What is the minimum number of states in a DFA that recognizes the set of all binary strings which contains four consecutive 1's?

   (a) 6 (b) 5 (c) 4 (d) 3

3. The string 1101 does not belong to the set represented by

   (a) 110*(0+1) (b) 1(0+1)*101
   (c) (10)*(01)*(00+11) (d) ((11)*+01)*

4. Pumping lemma is generally used for proving

   (a) A given grammar is regular
   (b) A given grammar is not regular
   (c) Whether two given regular expressions are equivalent or not
   (d) None of these

5. How many tuples are needed to represent an instantaneous description of a PDA?

   (a) 1 (b) 2 (c) 3 (d) 4

6. The language $\{a^m b^n c^{m+n} \mid m, n \geq 1\}$ is

(a) regular language (b) context free language
(c) contect sensitive but not context free (d) type-0 but not context sensitive

7. The class of context free language is not closed under

(a) Concatenation (b) intersection
(c) Union (d) Repeated concatenation

8. A PDM behaves like a TM when the number of auxiliary memory it has, is

(a) 0 (b) 1 or more (c) 2 or more (d) all the above

9. What is the maximum number of codes is generated to encode a turing machine which consists of four transition function?

(a) 12 (b) 24 (c) 36 (d) 48

10. The diagonalization language L_d is

(a) recursive (b) not recursively enumerable
(c) recursively enumerable (d) both (a) and (c)

PART - B (5 x 2 = 10 Marks)

11. Distinguish between NFA and DFA.

12. When two states are equivalent and distinguishable.

13. Let G = (N,T,P,S), P = { S →A1B / a, A → 0A / ε, B →0B / 1B / ε} give rightmost and leftmost derivation for 00101.

14. Design a turing machine for computing the function $f(x) = x + 1$.

15. Define the classes P and NP.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Explain the different forms of proofs with examples. (8)

(ii) Design DFA to check whether the given decimal number is divisible by 3. (4)

(iii) Design a DFA accepting all strings *w* over {0, 1} such that the number of 1's in *w* is 2 mod 4. (4)

Or

(b) (i) Consider the following Ɛ-NFA. Compute Ɛ-closure of each state and find its equivalent DFA. (10)

δ	Ɛ	a	b	c
→	ϕ	{p	{q	{r}
q	{p	{q	{r}	ϕ
*r	{q	{r}	ϕ	{p

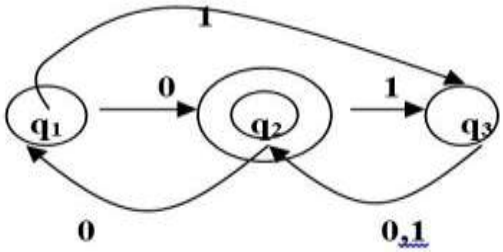
(ii) Design a DFA which accepts odd number of 1's and any number 0's. (6)

17. (a) (i) Prove that for every regular expression *r* there exist a NFA with *ε* transition that accepts *L(r)*. (10)

(ii) Show that the language $L = \left\{ \frac{o^{i^2}}{i \geq 1} \right\}$ is not regular. (6)

Or

(b) Obtain the regular expression that denotes the language accepted by, using the recursive relation. (16)



18. (a) (i) Let $S \rightarrow aB/bA$, $A \rightarrow aS/bAA/a$, $B \rightarrow bS/aBB/b$. Show that $S \Rightarrow aaabbabbba$ and construct a derivation tree whose yield is in *"aaabbabbba"*. (8)

(ii) Construct a PDA for the language $L = \left\{ \frac{a^n \ b^{2n}}{n \geq 1} \right\}$. (8)

Or

(b) (i) Construct a PDA for set of palindrome over the alphabet {a, b}.
L(M) = {WcW^R}. (8)

(ii) Show that the following grammars are ambiguous. (8)

19. (a) (i) Design a Turing machine which recognizes palindrome over alphabet {0,1}. (8)

(ii) Show that the language $L = \{a^i\ b^j c^i d^j / i \geq 1$ and $j \geq 1\}$ is not CFL. (8)

Or

(b) (i) Discuss the closure properties of CFL and prove any one of the property. (8)

(ii) Explain the programming techniques of Turing machine. (8)

20. (a) (i) Prove that Lu is RE but not recursive. (8)

(ii) Obtain the code for the TM M=({q1 q2,q3},{0,1} {0,1,B}, δ,q1,B,{q2}) With the moves δ(q1,1)=(q3,0,R), δ(q3,0)=(q1,1,R), δ(q3,1)=(q2,0,R), δ(q3,B)=(q3,1,L). (8)

Or

(b) (i) Define universal language L_u. Prove that L_u is recursively enumerable. (8)

(ii) State halting problem. Show that it is undecidable. (8)