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

Question Paper Code: 45204

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

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. Any NFA can be converted to a DFA

   (a) always (b) never
   (c) depending on the NFA (d) depending on the language of NFA

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 $L = \{0^m 1^m / m \geq 1\}$ is a

(a) regular language (b) context free language
(c) both (a) and (b) (d) none of these

7. While converting the context free grammar into Greibach normal form, which of the following is not necessary?

(a) elimination of null production
(b) elimination of unit production
(c) converting given grammar in Chomsky normal from
(d) none of these

8. Context free grammars are closed under

(a) union (b) kleene star (c) concatenation (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. Differentiate DFA and NFA.

12. When two states are equivalent and distinguishable.

13. Define the language generated by a PDA.

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) Prove that for every integer $n \geq 0$ the number $4^{2n+1} + 3^{n+2}$ is multiple of 13. (10)

(ii) Convert the given NFA to DFA. (6)

δ	0	1
→ q0	{ q0, q1}	q0
q1	q2	q1
q2	q3	q3
*q3	ϕ	q2

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) (i) Construct deterministic finite automata for the regular expression $(a + b)^* ab$. (8)

(ii) State and prove any two closure properties of regular language. (8)

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.

{S → aSbS/bSaS/ε} and {S →AB/aaB, A → a/aA, B → b}. (8)

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

(ii) Explain the programming techniques of turing machine. (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) State post correspondence problem. Let $\sum = \{a, b\}^*$. Let *A* and *B* be lists of three strings as given below

A = {b, bab^3, ba} B = {b^3, ba, a). Does this instance of PCP have a solution? (6)

(ii) Prove that for two recursive language L_1 and L_2, their union and intersection is recursive. (10)

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)