47

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

Question Paper Code : 20419

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fifth Semester

Computer Science and Engineering

CS 8501 — THEORY OF COMPUTATION

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give an example for proof by contradiction.

2. Mention the differences between deterministic finite automata and non-deterministic finite automata.

3. Give the regular expression that denotes the language consisting of all strings that are either a single 0 followed by any number of 1s or a single 1 followed by any number of 0s.

4. State any two closure properties for regular languages.

5. Derive the string 0110 from the following context free grammar:

$S \rightarrow 0A0$
$A \rightarrow 0A0 \mid 1A1 \mid \varepsilon$

6. What is meant by the yield of a parse tree?

7. Find an equivalent grammar for the following after eliminating ε -productions.

$S \rightarrow ASB \mid \varepsilon$
$A \rightarrow aAS \mid a$
$B \rightarrow SBS \mid A \mid bb$

8. Consider a Turing machine $M = (Q, \{0,1\}, \{0,1,B\}, \delta, [q_0, B, B], B, F)$. How ma symbols can be stored in the finite control of this turing machine?

9. What is the difference between Post's Correspondence problem and Modif Post's Correspondence problem?

10. State Rices theorem.

PART B — (5 × 13 = 65 marks)

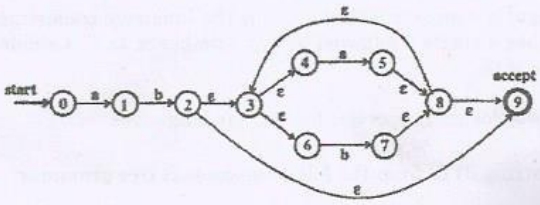
11. (a) (i) Construct an NFA that accepts all strings that end with 11.

(ii) Convert the following non-deterministic finite automaton (NFA) deterministic finite automaton (DFA) and informally describe language it accepts.

	0	1
$\rightarrow p$	$\{p,q\}$	$\{p\}$
q	$\{r,s\}$	$\{t\}$
r	$\{p,r\}$	$\{t\}$
*s	–	–
*t	–	–

Or

(b) Consider the following εNFA.



(i) Compute the ε -closure of each state.

(ii) Convert the automaton to DFA.

12. (a) State and prove the pumping lemma for regular languages.

Or

(b) Prove that every language defined by a regular expression is also defi by a finite automation.

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13. (a) Design a pushdown automaton (PDA) for the language $L = \{xx^R \mid x \text{ is in } (a+b^*)\}$. ($x^R$ is the reverse of x)

Or

(b) Convert the following grammar to a PDA that accepts the same language by empty stack.

$S \rightarrow 0S1 \mid A$

$A \rightarrow 1A0 \mid S \mid \varepsilon$

14. (a) If G is a context free grammar whose language contains at least one string other than ε, prove that there is a grammar G1 in Chomsky Normal Form, such that $L(G1) = L(G) - \{\varepsilon\}$.

Or

(b) Prove that context free languages are closed under union, concatenation, closure, positive closure, reversal and homomorphism.

15. (a) Define L_d, the diagonalization language. Explain the kind of strings L_d accepts Prove that L_d is not recursively enumerable.

Or

(b) Define L_{ne}. Prove that L_{ne} is recursively enumerable but not recursive.

PART C — (1 × 15 = 15 marks)

16. (a) Design a PDA that will accept the language $L = \{ab^icde^i \mid i \geq 1\}$.

Or

(b) Design a Turing machine for the language $L = \{a^nb^nc^n \mid n \geq 1\}$.

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