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

Question Paper Code : 70389

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth/Eighth Semester

Computer Science and Engineering

CS 6503 — THEORY OF COMPUTATION

(Common to : Information Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Draw a non-deterministic automata to accept strings containing the substring 0101.

2. State the pumping Lemma for regular languages.

3. Let G be the grammar with

   $S \rightarrow aB \mid bA$,
   $A \rightarrow a \mid aS \mid bAA$,
   $B \rightarrow b / bS / aBB$

   for the string aaabbabbba find the left most derivation.

4. Construct the context-free grammar representing the set of palindromes over $(0+1)^*$.

5. When is Push Down Automata (PDA) said to be deterministic?

6. What are the conventional notations of Push Down Automata?

7. Define Turing Machine.

8. Give the configuration of Turing machine.

9. What is primitive recursive functions.

10. Define NP completeness.

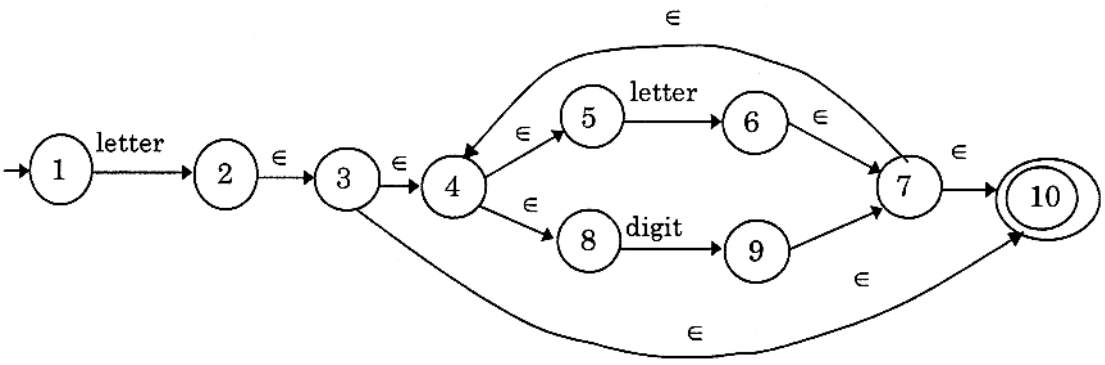
PART B — (5 × 13 = 65 marks)

11. (a) (i) Prove that "A language L is accepted by some DFA if and only if L is accepted by some NFA". (8)

(ii) Construct Finite Automata equivalent to the regular expression $(ab + a)^*$. (5)

Or

(b) (i) Consider the following ε - NFA for an indentifier. Consider the ε-closure of each state and find it' equivalent DFA. (8)



(ii) State the pumping lemma for Regular languages. Show that the set $L = \{0^{i2} \mid i \geq 1\}$ is not regular. (5)

12. (a) (i) Construct a Context Free Grammar for the language $L = \{a^n \mid n \text{ is odd}\}$ (5)

(ii) Define derivation tree. Explain its uses with an example. (8)

Or

(b) Obtain a grammar in Chomsky Normal Form (CNF) equivalent to the grammar G with the productions P given.

$S \rightarrow aAbB$

$A \rightarrow aA \mid a$

$B \rightarrow bB \mid b$ (13)

13. (a) (i) Construct a pushdown automaton to accept the following language L on $\Sigma = \{a, b\}$ by empty stack, $L = \{ww^R \mid w \in \Sigma^+\}$. (8)

(ii) What is an Instantaneous description of a PDA? How will you represent it? Also give the three important principles of ID and their transactions. (5)

Or

(b) (i) Explain acceptance by final state and acceptance by empty stack of a pushdown automata. (7)

(ii) State pumping lemma for CFL. Use pumping lemma to show that the language $L = \{a^i b^j c^k / i < j < k\}$ is not a CFL. (6)

14. (a) Construct Turning machine (TM) that replace all occurrence of 111 by 101 from sequence of 0's and 1's. (13)

Or

(b) (i) Explain techniques for Turing Machine Construction. (7)

(ii) Illustrate the Chomsky grammar classification with necessary example. (6)

15. (a) Explain recursive and recursively enumerable languages with suitable example. (13)

Or

(b) Explain tractable and intractable problem with suitable example. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Construct Turing machine for language over the input alphabet $\Sigma = \{a, b\}$ to shift the input symbol two positions left. (5)

(ii) Analyze and brief the concept of tractable and intractable problems. (10)

Or

(b) (i) State and prove the pumping lemma for CFL. (7)

(ii) Write an algorithm for minimization of DFA. (8)

———————