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**Question Paper Code : 91403**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fifth/Eighth Semester

Computer Science and Engineering

CS6503 – THEORY OF COMPUTATION

(Common to Information Technology)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Define a deterministic finite automaton.
2. Draw the transition diagram for the deterministic finite automaton accepting all strings with a substring 01.
3. Define context free grammar.
4. What is a parse tree ? Give example.
5. Define pushdown automaton.
6. When a pushdown automaton can be defined to be deterministic ?
7. What is a Turing machine ?
8. Present an outline of multi-tape Turing machine.
9. When is a language L recursively enumerable ?
10. What are polynomial-time algorithms ?

PART – B

(5×13=65 Marks)

11. a) Outline the steps in converting nondeterministic finite automaton to deterministic finite automaton. (13)  
(OR)  
b) "Not every language is a regular language". Using pumping lemma prove that many different languages are not regular. (13)



12. a) i) What are ambiguous grammars ? Give example. (6)  
 ii) When is a context free grammar said to be in Chomsky normal form ? Explain with an example. (7)
- (OR)
- b) i) Outline unit production and null production in a context free grammar with an example. (6)  
 ii) When is a context free grammar said to be in Greibach normal form ? Explain with an example. (7)
13. a) Given a context free grammar G, outline the steps to construct a pushdown automaton that simulates the left most derivations of G with an example. (13)
- (OR)
- b) Show that the language  $L = \{0^n 1^n \mid n \geq 1\} \cup \{0^n 1^{2n} \mid n \geq 1\}$  is a context-free language that is not accepted by any deterministic pushdown automaton. (13)
14. a) Design a Turing machine that will accept the language  $\{0^n 1^n \mid n \geq 1\}$  and draw the transition diagram for the Turing machine. (13)
- (OR)
- b) i) Outline the halting problem for Turing machines. (5)  
 ii) Present an outline of the Chomsky hierarchy of languages. (8)
15. a) i) Present a detailed note on primitive recursive functions. (8)  
 ii) Highlight the features of universal Turing machine. (5)
- (OR)
- b) i) Outline tractable and intractable problems with an example. (8)  
 ii) Show that any problem in P is also in NP but not the other way around. (5)

## PART - C

(1×15=15 Marks)

16. a) Write regular expression for the following languages :
- i) The set of all strings of 0's and 1's not containing 101 as a substring. (6)  
 ii) The set of strings of 0's and 1's, whose number of 0's is divisible by five and whose number of 1's is even. (9)
- (OR)
- b) Give transition tables for pushdown automata accepting each of the following languages :
- i)  $\{a^i b^j \mid i \leq j \leq 2i\}$  (7)  
 ii)  $\{x \in \{a, b\}^* \mid n_a(x) < n_b(x) < 2n_a(x)\}$ . (8)