Reg. No. :

Question Paper Code : 52380

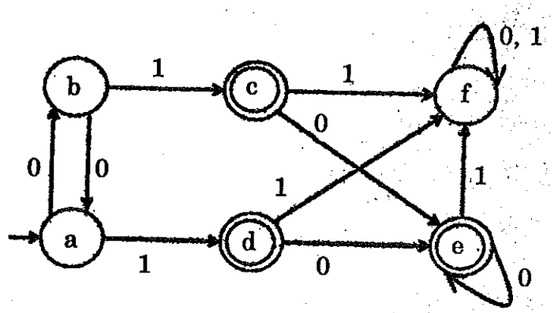
B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fifth/Seventh Semester
Computer Science and Engineering
CS 2303 – THEORY OF COMPUTATION
(Common to Information Technology)
(Regulations 2008)
(Also common to PTCS 2303 – Theory of Computation for B.E. (Part-Time)
Fifth Semester – CSE – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What is deductive proof ?
2. Differentiate NFA and DFA.
3. Define pumping lemma for regular grammar.
4. Convert the given DFA to complement DFA.



5. Is this grammar ambiguous ? Justify your answer.
   E —> E + E E —> E — E
   E--> E*E E—> E/E
   E—> id

6. Show that whether deterministic and nondeterministic push down automata are equivalent.

7. Compare DFA and Turing Machine.

8. Give the rules for the CFG normal forms.

9. When a language is said to be recursively enumerable language.

10. Define polynomial time Turing machine.

PART – B **(5×16=80 Marks)**

11. a) i) Draw the state diagram of an NFA with three states that recognizes the language $\{w \in \{0, 1\} \mid w \text{ is a multiple of } 4\}$.

ii) Convert NFA into a DFA using the subset construction (showing the states of the DFA as sets of states of the NFA).

iii) Show the correctness of the constructed DFA with examples. **(6+6+4)**

(OR)

b) Design deterministic finite state automata for the given languages. Show the correctness of construction.

$L_1 = \{w \mid w \text{ does not contain the substring } 110\}$

$L_2 = \{w \mid w \text{ contains an even number of 0's or exactly two 1's}\}$. **(8+8)**

12. a) Consider the language $F = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and if } i = 1 \text{ then } j = k\}$.

i) Show that F is not regular.

ii) Show that F acts like a regular language in the pumping lemma. In other words, give a pumping length p and demonstrate that F satisfies the three conditions of the pumping lemma for this value of p.

iii) Explain why parts (i) and (ii) do not contradict the pumping lemma. **(6+6+4)**

(OR)

b) Consider the DFA given in Q. No. 4. Construct minimized DFA using Myphill-Nerode Theorem. Show that it is equivalent to the given DFA. **(10+6)**

13. a) Construct pushdown automata for the given languages :

$L_1 = \{a^{2n} b^{3n} \mid n \geq 0\}$

$L_2 = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and, } i = j \text{ or } j = k\}$ **(8+8)**

(OR)

b) Design a deterministic Push Down Automata (PDA) which accepts the language $L = \{wcw^R \mid w \in \{a, b\}^*\}$. Check this PDA using the input abbcbba and abcab. Construct the equivalent CFG. **(6+5+5)**

14. a) Convert the following grammar G into Greibach Normal Form (GNF). **(16)**

$S \rightarrow XA \backslash BB$

$B \rightarrow b \backslash SB$

$X \rightarrow b$

$A \rightarrow a$

(OR)

b) Construct a Turing machine with input alphabet {a, b} to perform each of the following operations. Note that the tape head is scanning position zero in state q_f whenever a computation terminates. **(5+5+6)**

i) Move the input one space to the right. Input configuration q_0 BuB, result q_fBBuB.

ii) Concatenate a copy of the reversed input string to the input. Input configuration q_0BuB, result q_fBuu^{R}B.

iii) Erase the b's from the input. Input configuration q_0BbabaababB, result q_fBaaaaB.

15. a) i) State and explain RICE theorem. **(6)**

ii) Prove that the halting problem is undecidable. **(10)**

(OR)

b) i) Prove that if a language L and its complement are both recursively enumerable, then L is recursive. **(6)**

ii) Explain Post's Correspondence Problem (PCP). Prove that PCP is undecidable. **(10)**

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