S.No. : 351 BCS 3504

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Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 33223 Roll No. | 1 | 2 | 1 | 0 | 4 | 3 | 2 | 3 | 3 | 2 |

B. Tech. Examination 2023-24

(Odd Semester)

AUTOMATA THEORY

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION – A

1. Attempt all parts of the following : 8×1=8

   (a) What are applications of automata theory?

   (b) What are the applications of pumping lemma?

   (c) What are the properties of the CFL generated by a CFG?

   (d) State the equivalence of PDA and CFL.

   (e) What are the components of PDA?

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(f) Give an example of non-determnistic CFL.

(g) What are the special features of turing machine?

(h) What is 2-way infinite tage TM?

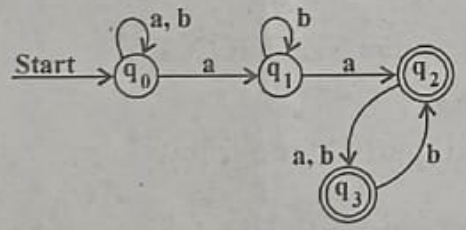
SECTION – B

2. Attempt any two parts of the following : 2×6=12

(a) Design DFA for the language :

$$L\ \{w \in (a, b)^*/n_b\ (w) \bmod 3 > 1\}$$

(b) Convert the following NFA into DFA :



(c) Construct a Moore machine which converts binary number to octal number.

(d) Construct a finite automata for the regular expression :

$$r = (a + b)^*\ a\ b\ b$$

SECTION – C

Note :– Attempt all questions. Attempt any two parts from each question. 5×8=40

3. (a) Write down a comparative study of regular expression, regular set and finite automata.

(b) Prove that language $L = \{0^n\ 1^m \mid n \leq m\}$ is not regular.

(c) Starting with the alphabet :

$$\Sigma = \{a, b, (\ ,\ ), +, *\}$$

Find a CFG that generates all regular expression.

4. (a) Show that the language $L = \{w\ w^R : w \in (a, b)^*\}$ is not inherently ambiguous.

(b) Find the CFG for the following language :

$$L = \{a^n\ b^{2n}\ c^m / n, m >= 0\}$$

(c) Change the following grammar into CNF :

$$S \rightarrow a\ b\ S\ b / a / a\ A\ b$$

$$A \rightarrow b\ S / a\ A\ A\ b$$

5. (a) Prove that the family of context free languages is closed under union, concatenation and Kleene star-closure.

(b) Design PDA for the grammar $G = (V_n, V_t, P, s)$ $V_n = \{s\}$, $V_t = \{a, b, c\}$ and P is defined as :

$$S \rightarrow a\,S\,a$$

$$S \rightarrow b\,S\,b$$

$$S \rightarrow c$$

(c) Design a turing machine (TM) that recognizes the language of all strings of even length over alphabet {a, b}.

6. (a) State and explain post correspondance problem with suitable example.

(b) Design turing machine to compute the function $F(n) = n^2$.

(c) When a recursively enumerable language is said to be recursive? Is it true that language accepted by a non-deterministic turing machine is different from recursively enumerable language.

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