S.No. : 389 NCS 4504

No. of Printed Pages : 05

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

PAPER ID : 43216 Roll No.

B. Tech. Examination, 2025-26

(Odd Semester)

AUTOMATA THEORY AND FORMAL LANGUAGE

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

Note :– Attempt all questions.

SECTION–A

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

(a) Define alphabet and string in automata theory.

(b) Define state transition graph.

(c) Write regular expression that accepts all the string for input alphabet {0,1} containing atmost 2 1's.

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(d) State Arden's theorem.

(e) Describe types of push down automata.

(f) Is it true, that language accepted by PDA empty stack or final state are different language?

(g) Explain universal turing machine.

(h) Define 2-way infinite tape.

SECTION – B

2. Attempt any two parts of the following : $2 \times 6 = 12$

(a) Write the definition of turing machine and also construct turing machine for the language :

$$(L) = \{a^{2n} b^n \mid n \geq 1\}$$

(b) Give the Chomsky hierarchy of grammar with their recognizes as well as the form of production rules.

(c) Define PDA. Construct PDA for the language :

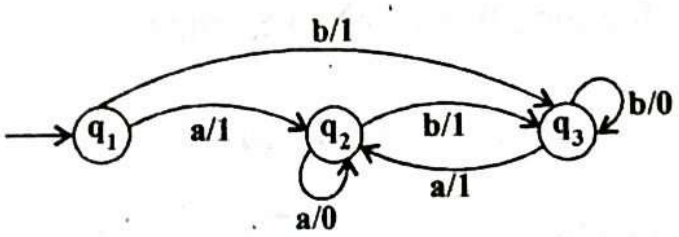
$$L = \{a^n b^m c^n \mid n, m \geq 1\}$$

(d) Discuss closure properties : concatenation, union, intersection, complement of regular language.

SECTION – C

Note :– Attempt all questions. Attempt any two parts from each questions. $8 \times 5 = 40$

3. (a) Convert the given Mealy machine as shown in figure into Moore machine. $\Sigma = \{a, b\}$ and $\Delta = \{0, 1\}$.



(b) Differentiate between DFA and NFA. Construct a minimal DFA for the language (L) which accepts all the strings "start and end" with different symbol over $\Sigma = \{a, b\}$.

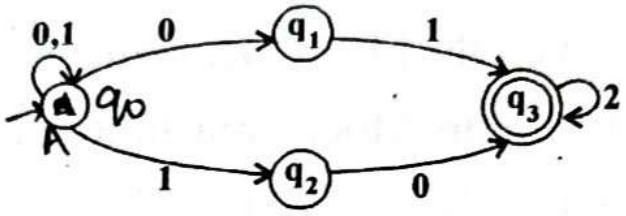
(c) Write a short note on the following :

(i) FA without output.

(ii) FA with output.

4. (a) Determine the finite automata accepted by the language describe by the regular expression $(0+1)^* 0 (0+1)^* 0 (0+1)^*$ over the alphabet $\{0, 1\}$ and also mention the accepted language.

(b) Find the regular expression of given FA by using Arden's theorem : $\Sigma = \{0, 1, 2\}$



(c) Reduce the given grammar :

$$G : \{(S, A, B), (a, b), P, S\}$$

to Chomsky normal form where P is defined by :

$$S \rightarrow bA \mid aB$$

$$A \rightarrow bAA \mid aS \mid a$$

$$B \rightarrow aBB \mid bS \mid b$$

5. (a) What is push down automata? Explain with diagram.

(b) Construct PDA for the language :

$$(L) = \{a^n c\, b^{2n} \mid n \geq 1\}$$

over alphabet $\Sigma = \{a, b, c\}$. Specify the acceptance state.

(c) Differentiate PDA by empty stack and final state by giving their definitions.

6. (a) Explain turing machine with block diagram.

(b) Construct a turing machine which accepts the language :

$$(L) = \{0^n 1^n \mid n \geq 1\}$$

(c) Design TM for the language :

$$(L) = \{a^{n+2} b^n \mid n > 0\}$$

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