



Date: 24-06-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

Answer ALL questions

1. (a) Design FA which accepts odd number of ones and any number of zeros. (5)

(OR)

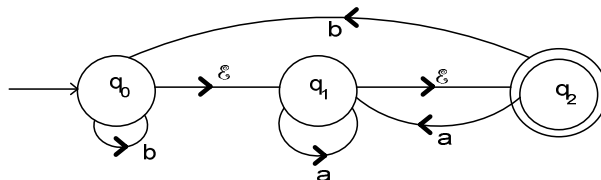
- (b) Write any five applications of Automata theory. (5)

- (c) (i) Design finite automata which checks whether the given decimal number is divisible by 3.

- (ii) Design an NFA to accept set of strings over $\{0,1\}$ such that it ends with two consecutive zeros. (8+7)

(OR)

- (d) Convert the following NFA with ϵ to equivalent DFA.



(15)

2. (a) Define regular expression. Also, write the regular expression for the language accepting the strings which are starting with 1 and ending with 0 over $\Sigma = \{0,1\}$.

(5)

(OR)

- (b) Using the identities of regular of expressions, prove that

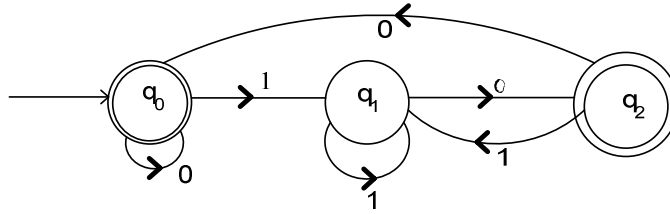
(i) $(0^*1^*)^* = (0 + 1)^*$ (ii) $(r + s)^* \neq r^* + s^*$ (5)

- (c) Construct NFA with ϵ moves which accept the language defined by the regular expression

$r = ((0 + 1)^*10 + (00)^*(11))^*$. (15)

(OR)

- (d) Construct the regular expression from the given DFA using Arden's method.



(15)

3. (a) Without changing the meaning of the grammar, eliminate ϵ –productions and unit productions for the following CFG: $S \rightarrow aSa, A \rightarrow B, S \rightarrow bSb, S \rightarrow \epsilon$. (5)

(OR)

- (b) Define Ambiguity and check whether the given grammar is ambiguous or not?

$$S \rightarrow iCtS, S \rightarrow iCtSeS, S \rightarrow a, C \rightarrow b. \quad (5)$$

- (c) Explain leftmost derivation, rightmost derivation and phase trees with suitable examples. (15)

(OR)

- (d) Reduce the following CFG to the Chomsky normal form.

$$S \rightarrow 1A/0B$$

$$A \rightarrow 1AA/0S/0$$

$$B \rightarrow 0BB/1S/1. \quad (15)$$

4. (a) Construct PDA which accepts only odd number of a's over $\Sigma = \{a, b\}$. (5)

(OR)

- (b) Write short notes on (i) Input tape (ii) finite control and (iii) stack in pushdown automata. (5)

- (c) Construct push down automata for the language of any combinations of 0's and 1's using Chomsky normal form. (15)

(OR)

- (d) Design deterministic pushdown automata which accepts the language $L = \{0^n 1^{3n} / n \geq 0\}$. Further, trace your PDA for the input with $n = 3$. (15)

5. (a) Write short note on the history and application of Turing Machine. (5)

(OR)

- (b) Construct Turing Machine for the successor function for a given unary number. (5)

- (c) Design Turing Machine for checking well-formedness of the parenthesis. In addition, construct the transition table and trace your TM with different inputs. (15)

(OR)

- (d) Construct a Turing Machine for the linear function $f(x) = x + 5, x \in N$. Also, simulate the machine for any two input values of x . (15)

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