29 MAY 2019

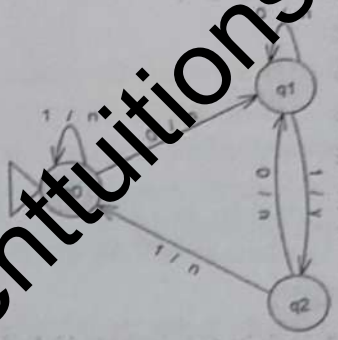
SE/IT/SEM IV/AT/CBCS

(3 Hours) [Total Marks: 80]

1. Question No. 1 is **compulsory**.
2. Out of remaining questions, attempt any **three** questions.
3. Assume **suitable** data wherever required but **justify** the same.
4. **All** questions carry **equal** marks.
5. Answer to each new question to be started on a fresh page.
6. **Figure** to the **right** in brackets indicate **full** marks.

1. **Solve any four from the followings.**

(a) Construct Moore machine equivalent to following Mealy machine. [05]



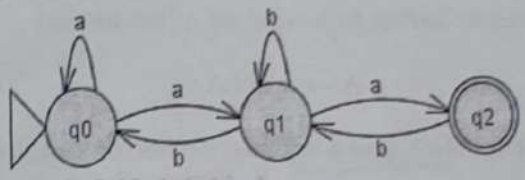

(b) Construct a PDA for the following Context Free Grammar (CFG). [05]

$S \rightarrow CBA$ $A \rightarrow 0A0 \mid 0$ $B \rightarrow 0B \mid 0$ $C \rightarrow 0C1 \mid 1C0 \mid \varepsilon$

(c) Construct right linear grammar and left linear grammar for the regular expression $1(01)^*0(0 + 1)^*$. [05]

(d) Explain the concepts, acceptance by final state and acceptance by empty stack of a Pushdown automata with suitable example. [05]

(e) Construct regular expression for the following FA using state elimination method. [05]

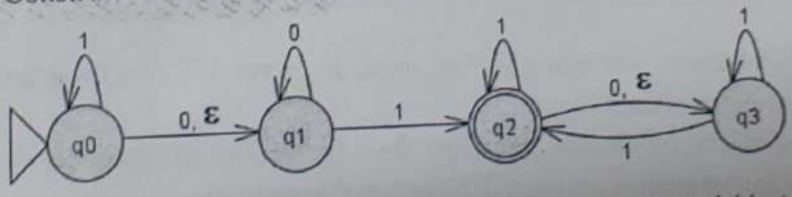



2. (a) Write down the regular expressions for the following language. [04]

i. L is the language of all strings over {0, 1} having odd number of 0's and any number of 1's.

ii. L is the language of all strings over {0, 1} having number of 1's multiple of three.

(b) Construct DFA for the following NFA with ε-moves. [10]




(c) Construct NFA with ε-moves for the regular expression $ab^*(a + b)^* + ba^*$ [06]



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3. (a) Covert the following context free grammar into Chomsky normal form. [10]

$S \rightarrow A \mid C \quad A \rightarrow aA \mid a \mid B \quad B \rightarrow bB \mid b \mid \varepsilon \quad C \rightarrow cC \mid c \mid B$

(b) Construct a Context Free Grammar (CFG) for the following PDA. [10]

$M = (\{q_0, q_1\}, \{(, ), [, ]\}, \{(, [, Z_0\}, \delta, q_0, Z_0, \Phi)$ and $\delta$ is given by:

$\delta(q_0, (, Z_0) = (q_0, (Z_0)$

$\delta(q_0, [, Z_0) = (q_0, [Z_0)$

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$\delta(q_0, ), () = (q_0, \varepsilon)$

$\delta(q_0, ], [) = (q_0, \varepsilon)$

$\delta(q_0, \varepsilon, Z_0) = (q_1, \varepsilon)$

4. (a) Construct a PDA for $L = \{a^n b c^m \mid n, m \geq 1 \text{ and } n < m\}$. [10]

(b) Design a DFA over $\{0, 1\}$ which accepts all strings that contain substring '11' and do not contain the substring '00'. [06]

(c) Give context free grammar for the following languages. [04]

i. $L = \{a^n 1^m b^k \mid m > n + k \text{ and } n, m, k \geq 0\}$

ii. $L = \{a^{2n} b^{3m} c^m d^n \mid n, m \geq 1\}$

5. (a) Construct Turing Machine to accept language $L = \{a^n b^{2n+1} \mid n \geq 1\}$. [10]

(b) Find the equivalent NFA with $\epsilon$-moves accepting the regular language defined by the following grammar. [05]

$S \rightarrow 01S \mid 0A \quad A \rightarrow 10 \mid 1B \mid 00A \quad B \rightarrow 1S \mid 1B \mid \epsilon$

(c) Let G be the grammar having following set of production. [05]

$S \rightarrow ABA \quad A \rightarrow aA \mid bA \mid \epsilon \quad B \rightarrow bbb$

For the string "ababbbba", find a leftmost derivation and rightmost derivation.

6. (a) Minimize the following DFA $M = (\{q_0, q_1, q_2, q_3, q_4, q_5\}, \{0, 1\}, \delta, q_0, \{q_3, q_5\})$, where $\delta$ is given in the following table. [06]

| | $\rightarrow q_0$ | $q_1$ | $q_2$ | $*q_3$ | $q_4$ | $*q_5$ |
|---|---|---|---|---|---|---|
| 0 | $q_1$ | $q_3$ | $q_5$ | $q_3$ | $q_5$ | $q_3$ |
| 1 | $q_2$ | $q_4$ | $q_1$ | $q_4$ | $q_1$ | $q_4$ |

(b) Construct Turing Machine wherein given an input $1^n$ leaves $1^{3n+1}$ on the tape. Covert the TM design into equivalent function. [10]

(c) What do you understand by closure property? State the various set theoretic operations under which regular languages are closed. Give suitable example. [04]

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