

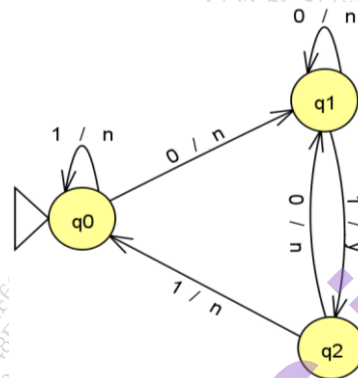
(3 Hours)

[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]



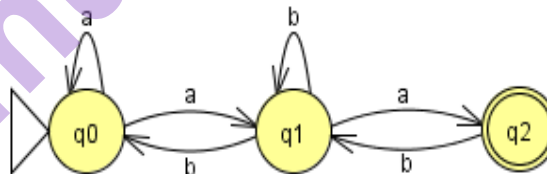
(b) Construct a PDA for the following Context Free Grammar (CFG). [05]

$$S \rightarrow CBAA \quad A \rightarrow 0A0 \mid 0 \quad B \rightarrow 0B \mid 0 \quad C \rightarrow 0C1 \mid 1C0 \mid \epsilon$$

(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]

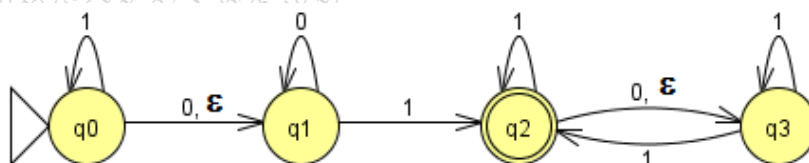
(e) Construct regular expression for the following FA using state elimination method. [05]



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]

3. (a) Convert 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 δ is given by:
 $\delta(q_0, (, Z_0) = (q_0, (Z_0)$
 $\delta(q_0, [, Z_0) = (q_0, [Z_0)$
 $\delta(q_0, (, () = (q_0, (($
 $\delta(q_0, [, []) = (q_0, [[$
 $\delta(q_0, (, []) = (q_0, ([$
 $\delta(q_0, [, ()) = (q_0, [($
 $\delta(q_0,), () = (q_0, \varepsilon)$
 $\delta(q_0,], []) = (q_0, \varepsilon)$
 $\delta(q_0, \varepsilon, Z_0) = (q_1, \varepsilon)$
4. (a) Construct a PDA for $L = \{a^n b^m \mid n, m \geq 1 \text{ and } n < m\}$. [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. $L = \{0^n 1^m 0^k \mid m > n + k \text{ and } n, m, k \geq 0\}$
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 ϵ -moves accepting the regular language defined by the following grammar. [05]
 $S \rightarrow 01S \mid 0A \quad A \rightarrow 10 \mid 1B \mid 00A \quad B \rightarrow 1S \mid 1B \mid \varepsilon$
(c) Let G be the grammar having following set of production. [05]
 $S \rightarrow ABA \quad A \rightarrow aA \mid bA \mid \varepsilon \quad B \rightarrow bbb$
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 δ 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. Convert 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]