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

PAPER ID : 0112 **Roll No.**

B.Tech.

(SEM. IV) EVEN THEORY EXAMINATION 2012-13

THEORY OF AUTOMATA & FORMAL LANGUAGES

Time : 3 Hours *Total Marks : 100*

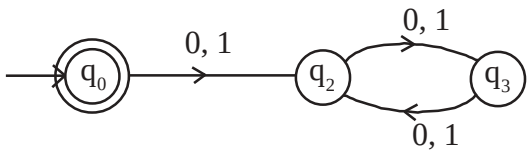
Note :– Attempt **all** questions. All questions carry equal marks.

1. Attempt any **four** parts of the following :

   (a) For the given languages $L_1 = \phi$, $L_2 = \varepsilon$, and $L_3 = \{0, 1\}^*$. Compute $L_1.L_2$ and $L_2 \cup L_3$.

   (b) Construct a DFA for the language that contains the strings ending with 0.

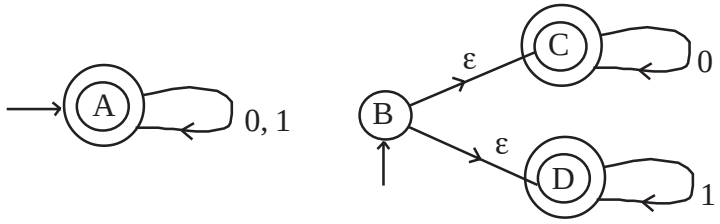
   (c) Define the language of the following finite automaton.



   (d) Let $M = (Q, \Sigma, q_o, F, \delta)$ be an NFA. Show that for any $q \in Q$ and $a \in \Sigma$,

$$\hat{\delta}(q, a) = \delta(q, a)$$

   (e) From the given NFAs, decide whether the two accept the same language



(f) Let L = {0 1} {0, 1}*; construct NFA with ε moves that accepts L^2.

2. Attempt any **two** parts of the following :

(a) Construct a DFA accepting the following language :

$(010 + 00)^*(10)^*$

(b) Let r_1 and r_2 be two regular expressions defined as follows :

$r_1 = (00^*1)^*1$

and $r_2 = 1 + 0(0 + 10)^*11$.

Prove that $r_1 = r_2$.

(c) Prove that the language

$L = \{0^n \mid n \text{ is prime}\}$

is not regular.

3. Attempt any **two** parts of the following :

(a) Find a Context Free Grammar (CFG) generating the following language :

$L = \{a^i b^j c^k \mid i = j \text{ or } i = k\}$

(b) Describe the language generated by the following grammar :

$S \rightarrow bS/aA/\varepsilon$

$A \rightarrow aA/bB/b$

$B \rightarrow bS$

(c) Show that the given grammar is ambiguous. Also find an equivalent unambiguous grammar.

$S \rightarrow ABA$

$A \rightarrow aA/\varepsilon$

$B \rightarrow bB/\varepsilon$

4. Attempt any **two** parts of the following :

(a) Define a Push Down Automaton (PDA). Construct a PDA accepting the language of palindromes.

(b) Construct a deterministic PDA for the following language :

$L = \{x \in \{a, b\}^* \mid n_a(x) \neq n_b(x)\}$

where $n_a(x)$: number of a's in the string x

$n_b(x)$: number of b's in the string x

(c) Show that if L is a language of Deterministic PDA (DPDA) and R is regular then $L \cap R$ is a language of DPDA.

5. Attempt any **two** parts of the following :

(a) Construct a turing machine for reversing a string.

(b) Let T_1 and T_2 be two Turing machines; compute the functions f_1 and f_2 from N to N (where N is a natural number), respectively, construct a Turing machine that computes the function min (f_1 , f_2).

(c) Prove that every recursively enumerable language where complent is closed must be recursive.