

**B. E. Fifth Semester ( Computer Technology ) / SoE – 2014-15  
Examination**

Course Code : CT 1301 / CT 301

Course Name : Theoretical Foundation  
of Computer Science

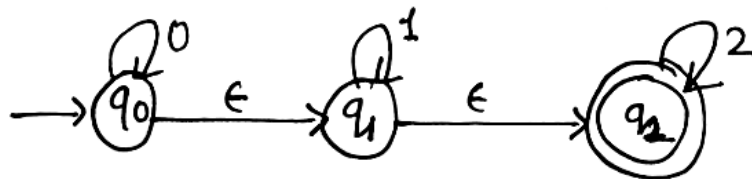
Time : 3 Hours ]

[Max. Marks : 60

**Instructions to Candidates :—**

- (1) All questions are compulsory.
- (2) All questions carry marks as indicated.
- (3) Due credit will be given to neatness.
- (4) Assume suitable data wherever necessary.
- (5) Diagrams should be given wherever necessary.

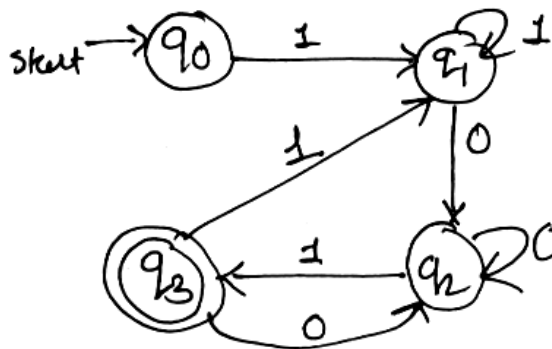
1. (A) Obtain NFA without  $\epsilon$ -moves equivalent to the following NFA :



7 (CO 1)

OR

Construct the minimum state Automata equivalent to transition diagram given below :



7 (CO 1)

- (B) Compare between a NFA and DFA with an example.

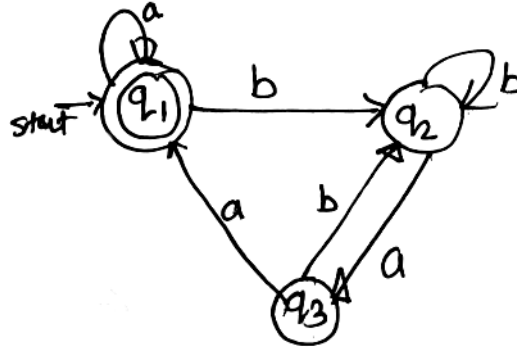
3 (CO 1)

OR

Design a DFA for the language  $L = \{0^m 1^n, m \geq 0, n \geq 1\}$ .

3 (CO 1)

2. (A) Find the regular expression corresponding to the automaton given in following fig :



7 (CO 1)

OR

Design DFA for language of  $\{a, b\}$  containing 'aba' as substring and not 'bab' as substring.

7 (CO 1)

- (B) Comment on the statement "Intersection of two regular languages is a regular language".

3 (CO 1)

OR

Construct DFA equivalent to the given regular expression.

3 (CO 1)

3. (A) Construct a grammar in GNF equivalent to the grammar :

$S \rightarrow AA \mid a$

$A \rightarrow SS \mid b$

7 (CO 2)

OR

Reduce the following grammar to CNF :

$S \rightarrow aAD$

$A \rightarrow aB \mid bAB$

$B \rightarrow b$

$\epsilon \rightarrow d$

7 (CO 2)

- (B) What do you mean by left linear and right linear grammar ? Explain with an example. 3 (CO 2)

**OR**

Show that the grammar  $E \rightarrow E + E / E * E / id$  is ambiguous. 3 (CO 2)

4. (A) Design a pushdown automata for accepting the following language :—  
 $L = \{0^n 1^m 0^{m+n} \mid m, n \geq 1\}$  7 (CO 3)

**OR**

Design a pushdown automata for accepting the following language :—  
 $L = \{X c X^R \mid X \in (a, b)^*\}$  7 (CO 3)

- (B) Comment on the statement : "PDA is more powerful than FA". 3 (CO 3)

**OR**

Design PDA for the language  $L = \{a^{2n} b^n \mid n \geq 1\}$ . 3 (CO 3)

5. (A) Design a Turing Machine (TM) which accepts the language :  
 $L = \{W \in (a + b)^* \mid W \text{ contains equal no. of a's and b's}\}$ . 7 (CO 4)

**OR**

Design a Turing Machine (TM) for the language  $L = \{a^n b^n c^n \mid n \geq 1\}$ . 7 (CO 4)

- (B) Write short note on Church's Hypothesis. 3 (CO 4)

**OR**

Design Turing Machine (TM) to find 2's complement of binary number. 3 (CO 4)

6. (A) Does a PCP with  $X = (b, bab^3, ba)$  and  $Y = (b^3, ba, a)$  has solution ?  
Explain. 7 (CO 4)

**OR**

Prove that PCP with two lists  $X = (01, 1, 1)$ ,  $Y = (01^2, 10, 1^2)$  has no solution ? 7 (CO 4)

- (B) Write short note on Halting problem. 3 (CO 4)

**OR**

Compute  $A(2, 1)$  using Ackermann's Function. 3 (CO 4)