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Printed Pages : 4 **CS –404**

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

PAPER ID : 1032 Roll No.

B. Tech.

(SEM. IV) EXAMINATION, 2006-07
THEORY OF AUTOMATA & FORMAL LANGUAGES

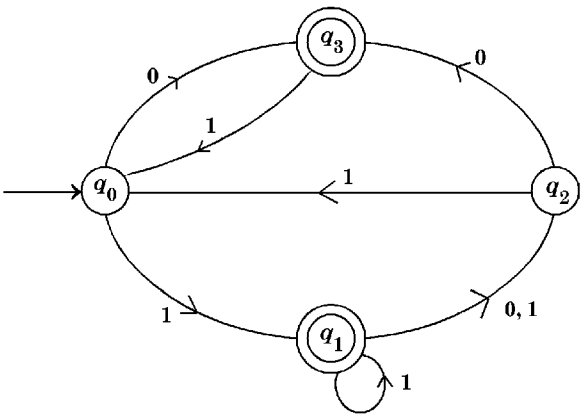
Time : 3 Hours] *[Total Marks : 100*

***Note** : Attempt **all** questions.*

1 Attempt any **four** of the following : **5×4=20**

(a) Construct a DFA that accepts the strings which contains the alphabets pattern 011 $(\Sigma = \{0, 1\})$.

(b) For the given state diagram of a NFA. Convert it to an equivalent DFA.

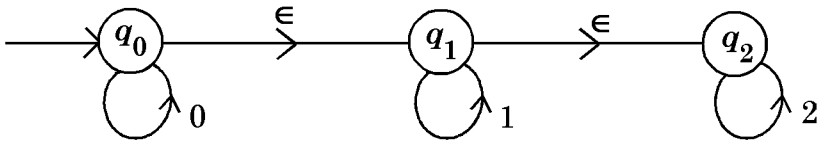


(c) Construct the ***FA*** for the language L_n $(for\ n \geq 1)$ i.e.

$L_n = \{x \in \{0, 1\}^* \mid 1 \times 1 \geq n$ *and* n^{th} *symbol from the right in* x *is* $1\}$

(d) Draw a Moore or Mealy machine that generates output 'Yes' when accepts a set of strings from (0+1)* terminating in last two same symbols.

(e) Construct a DFA from the given NFA with $\in$ moves.



(f) Minimize the DFA corresponding to NFA of question 1(b).

2 Attempt any **two** : **10×2=20**

(a) Illustrates the pumping lemma for regular languages. Prove that language $L = \left\{ O^{i^2} \mid i \geq 0 \right\}$ is not regular.

(b) Show that CFG G with following productions

$$S \rightarrow a \mid Sa \mid bSS \mid SSb \mid SbS$$

is an ambiguous grammar. Can you convert it to an unambiguous grammar ?

(c) Convert the given grammar into GNF :

$$S \rightarrow AA \mid a$$
$$A \rightarrow SS \mid b$$

3 Attempt any **two** : **10×2=20**

(a) Construct the grammar for the language

$$L = \left\{ a^{n^2} \mid n \geq 1 \right\}$$

Identify the type of the grammer obtain.

(b) How to make a PDA deterministic i.e. DPDA. Construct the DPDA for the language

$$L = \{x \in \{a, b\}* \mid x \text{ has equal number of } a\text{'s and } b\text{'s}\}$$

(c) Given a context free grammar. How do you determine that the grammar as :

(i) Empty or Non-empty

(ii) Finite or non-finite

(iii) Whether a string x belongs to the language of the grammar.

4 Attempt any **two** : **10×2=20**

(a) State and prove that Post correspondence problem (PCP) is undecidable.

(b) Let f_1 and f_2 are two natural functions which are computed by TMs M_1 and M_2 respectively. Construct a TM that computes max (f_1, f_2).

(c) Design a turing machine that recognises the following $L = \{a^n b^n \mid n \geq 1\}$.

5 Attempt any **two** parts of the following : **10×2=20**

(a) Give the complete hierarchy of grammars with their recognizers as well as the form of production rules.

(b) Write a left linear grammar for the following language. All strings of $(a+b)^*$ such that bbb is a substring in them.

(c) Define context sensitive grammars and Linear Bound Automata ***(LBA)***.
