



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

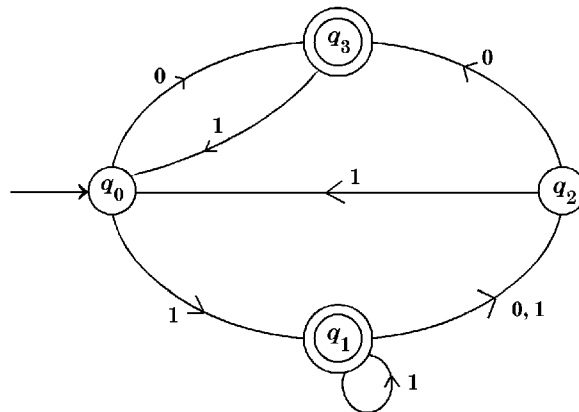
Time : 3 Hours]

[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.

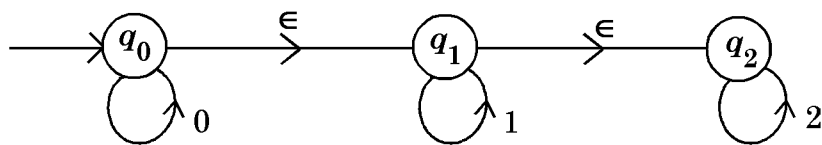
$$L_n = \{x \in \{0, 1\}^* \mid 1 \times 1 \geq n \text{ and } n^{\text{th}} \text{ symbol from the right in } x \text{ is } 1\}$$

V-1032]

1

[Contd...

- (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 ϵ 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 $L = \{0^i 2^i \mid i \geq 0\}$ is not regular.
- (b) Show that CFG G with following productions

$$S \rightarrow a | Sa | bSS | SSb | Sbs$$

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

- (c) Convert the given grammar into GNF :

$$S \rightarrow AA | a$$

$$A \rightarrow SS | b$$

3 Attempt any **two** : **10×2=20**

(a) Construct the grammar for the language

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

Identify the type of the grammar 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**).
