Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No. .....

CS–505

B. E. (Fifth Semester) EXAMINATION, June, 2009

(Computer Science & Engg. Branch)

THEORY OF COMPUTATION

(CS–505)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *one* question from each Unit. Assume suitable data wherever necessary.

Unit–I

1. (a) Show by induction that $n^4 - 4n^2$ is divisible by 3 for all $n \geq 0$. 8

   (b) Construct minimised DFA for the given NFA. 12

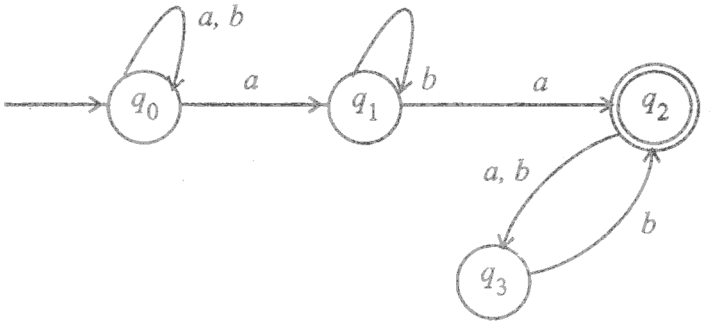

Fig. 1

P. T. O.

Or

2. (a) Construct DFA for the given WFA. 12

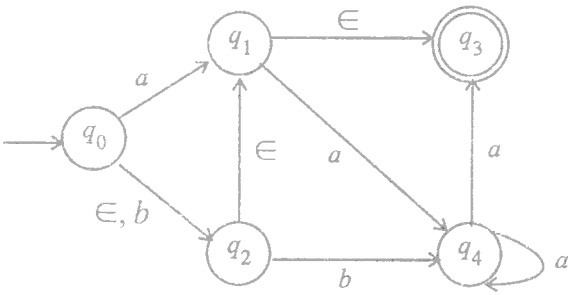

Fig. 2

(b) Explain Myhill-Nesode method of minimisation. 8

Unit – II

3. (a) State and prove the pumping lemma theory of Regular language. 10

(b) Find out whether the following grammars generate the same language : 10

G_1 : $A \rightarrow 0B \mid 1E$
$B \rightarrow 0A \mid 1F \mid \in$
$C \rightarrow 0C \mid 1A$
$D \rightarrow 0A \mid 1D \mid \in$
$E \rightarrow 0C \mid 1A$
$F \rightarrow 0A \mid 1B \mid \in$

G_2 : $X \rightarrow 0Y \mid 0 \mid 1Z$
$Y \rightarrow 0X \mid 1Y \mid 1$
$Z \rightarrow 0Z \mid 1X$

Or

4. (a) Write a CFG to generate the language : 6

$$L = \{0^m 1^n 0^{m+n} \mid m, n \geq 1\}$$

(b) Simplify the given grammar : 6

$S \rightarrow aSB \mid aA \mid bB$
$A \rightarrow aA \mid \in$
$B \rightarrow bB \mid \in$

(c) Consider the following grammar and obtain an equivalent grammar in CNF : 8

$S \rightarrow AB \mid 0C2$ $\quad C \rightarrow 0C2 \mid 0D1 \mid 01$

$A \rightarrow 0A1 \mid 01$ $\quad D \rightarrow 0D1 \mid 01$

$B \rightarrow 1B2 \mid 12$

Unit – III

5. (a) Give the CFG generating the language accepted by the following PDA : 12

$M = (\{q_0, q_1\}, \{0, 1\}, \{z_0, x\}, \delta, q_0, z_0, \phi)$

$\delta(q_0, 1, z_0) = \{(q_0, z_0)\}$ $\quad \delta(q_0, \in, z_0) = \{(q_0, \in)\}$

$\delta(q_0, 1, x) = \{(q_0, xx)\}$ $\quad \delta(q_1, 1, x) = \{(q_1, \in)\}$

$\delta(q_0, 0, x) = \{(q_1, x)\}$ $\quad \delta(q_1, 0, z_0) = \{(q_0, z_0)\}$

(b) Explain the difference between Deterministic PDA and Non-deterministic PDA with example. 8

Or

6. (a) Construct PDA accepting $L = \{a^i b^j \mid j = i \text{ or } j = 2i\}$. 10

(b) Construct a PDA equivalent to the following grammar : 10

$S \rightarrow aAA$

$A \rightarrow aS \mid bS \mid a$

Unit – IV

7. (a) Design a Turing machine that computes a function $f(m, n) = m \dot{-} n$ i. e. proper subtraction of two integers defined as : 12

$$m \dot{-} n = m - n \quad \text{if } m > n$$

$$= 0 \quad \text{otherwise}$$

(b) Explain Turing thesis briefly. 8

Or

8. (a) Explain how Turing machine can be used as generating device. 8

   (b) Construct Turing machine for accepting L : 12

$$L = \{a^n b^n \mid n \geq 0\}$$

Unit – V

9. (a) Prove that the halting problem of turing machine is undecidable. 10

   (b) Explain recursively enumerable languages. 10

Or

10. (a) Explain the post-correspondence problem briefly. 8

    (b) Write brief notes on the following : 12

    (i) Ackermann's function

    (ii) Primitive recusive function

    (iii) Markov algorithms