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Name.........................

Reg. No.....................
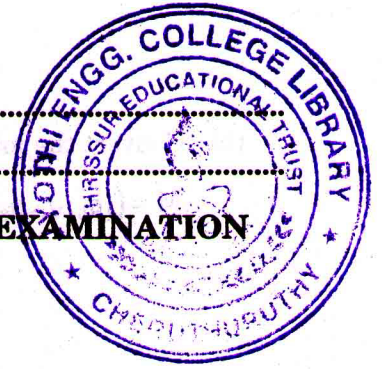
FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2011

CS 04 506—THEORY OF COMPUTATION

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

Part A

I. (a) Define 'regular expression'. Give an example.

(b) Define 'NFA'. Give an example.

(c) Define 'PDA'.

(d) Briefly discuss 'left most derivation' of a string *w*.

(e) Show that union of recursive languages is recursive.

(f) Briefly describe nondeterministic TMs.

(g) Discuss class of P problems.

(h) Distinguish between NP-hard and NP-complete. Give example for each.

(8 × 5 = 40 marks)

Part B

II. (a) (i) Construct regular expression R that describes the language

L(R) = {*w* / *w* starts and ends
with the same symbol
over the alphabet {0,1}}

(8 marks)

(ii) Design a NFA that accepts all strings over {0, 1} containing a 1 in the third position from the end (e.g. 00100 is accepted but 0011 is not accepted).
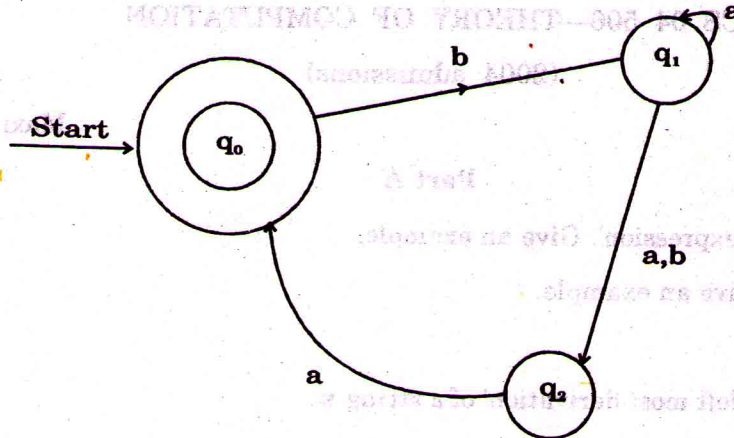
(7 marks)

Or

Turn over

(b) Convert the following NFA into an equivalent DFA :

$$M = \left(\{q_0, q_1, q_2\}, \{a, b\}, \delta, \{q_0\}, \{q_0\}\right) \text{ given by :}$$

Justify your answer.

(15 marks)

III. (a) Design a PDA that recognizes the language $\{a^n b^n \mid n \geq 0\}$ and explain its working.

Or

(b) (i) Convert the following CFG into an equivalent Chonsky normal form :

$$S \rightarrow ASA \mid aB$$
$$A \rightarrow B \mid S$$
$$B \rightarrow b \mid E$$

(10 marks)

(ii) State the pumping lemma for CFLs.

(5 marks)

IV. (a) Design a TM that decides the language $B = \{w \neq w / w \in \{0, 1\}^*\}$.

(15 marks)

Or

(b) (i) Design a TM to compute $f(m, n) = m * n, \forall m, n \in N$.

(10 marks)

(ii) Write a short note on 'multitape TM'.

(5 marks)

V. (a) Briefly describe CLIQUE problem and then prove that it is in NP.

(15 marks)

Or

(b) Prove that SAT is NP complete.

(15 marks)

[4 × 15 = 60 marks]