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Fifth Semester Examination – 2006
Automata Theory

Full Marks – 70 **Time – 3 hours**

Answer Question No. 1 which is compulsory and any five from the rest.

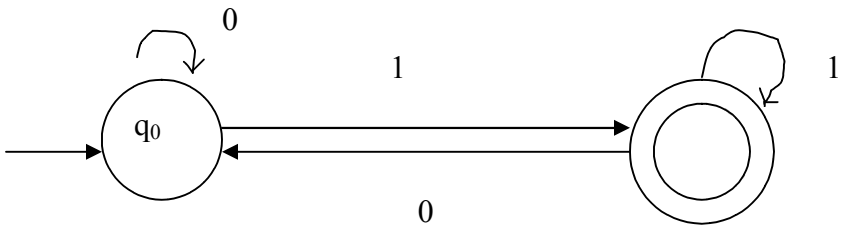
The figures in the right-hand margin indicate marks.

1. Answer ALL questions: (2 x 10

(a) Define DFA.

(b) Devise a finite automation which accepts all strings ending with two zeroes. (Assume that the alphabet is {0,1}

(c) Describe the language recognized by the following DFA.



(d) What do you mean by NPA with $\in$ - transition?

(e) State the pumping lemma for regular languages.

(f) Define a context-free grammar.

(g) State the Choksky normal form for a context-free grammar.

(h) Define a pushdown automation.

(i) When is a language L said to be decidable?

(j) Give at least two examples of problems which belong to the class P.

2.

(a) Construct a DFA which accepts all strings of binary integers which are divisible by 2. (5

(b) Define a language to be regular if it is recognized by a finite automation. Show that if the language L_1 and L_2 are regular, so is the language $L_1 \cup L_2$.

(5

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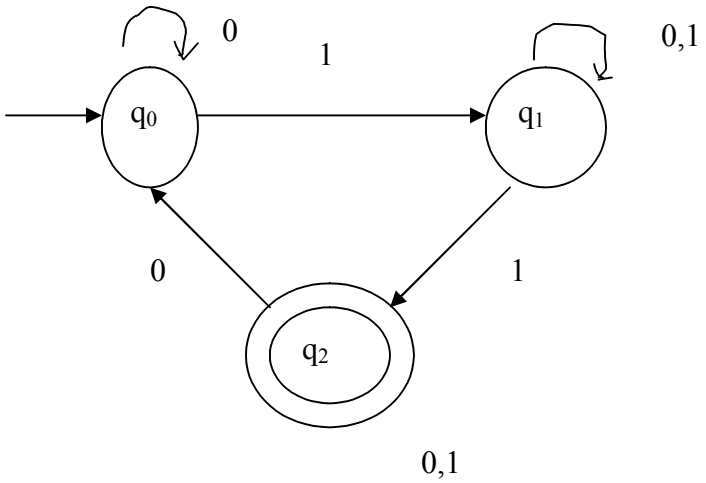
3.

(a) Given the NFA



find the corresponding DFA equivalent to it. (5

(b) Show that the set of regular language is closed under the coacatenation operation. (5

4.

(a) Prove the pumping lemma for regular languages. (5

(b) Use the pumping lemma to prove that (5

$L = \{O_n\ 1_n : n \geq 1\}$

is not a regular language over the alphabet

$\sum = \{0,1\}$

5.

(a) Determine the language generated by each of the following productions: (5

(i) $S \rightarrow aA$, $S \rightarrow a\ S$, $A \rightarrow ab$

(ii) $S \rightarrow abS$, $S \rightarrow aA$, $A \rightarrow a$

(iii) $S \rightarrow aSb$, $S \rightarrow \in$.

(b) Design a push-down automation that recognizes the language (5

$L\{ww^v : w = \in \{0,1\}^*\}$

Where w^v represents the word w written backwards.

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6.

(a) Assume the following theorem : "a.language L is contest-free if some pushdown automation recognizes it" and prove that the language (5

$L = \{ O^n t^n : n > 1\}$

is context-free.

(b) Give a contest-free grammar that generates the language. (5

$L=\{w \in \{a,b\}^* : w$ contains at least three $a's\}$

7.

(a) Define a Turing machine, explaining all the concepts. (4

(b) Explain the following sentence : (i) a language is Turing recognizable. (3

(c) Are there languages which are not Turing recognizable? Explain your answer. (3

8.

(a) Define a universal Turing machine. (5

(b) What do you mean by saying that a problem in class NP. Describe some problems which belong to this class. (5

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