Total No. of Questions : 8] [Total No. of Printed Pages :

MCA–404(O)

M. C. A. (Fourth Semester)
EXAMINATION, Nov.-Dec., 2007
(Old Course)
THEORY OF COMPUTATION
[MCA–404(O)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equa marks.

1. (a) Consider the Language S* where S = {*aa uba baa*} Show that the words *aabaa, baaabaaa* an *baaaaababaaaa* are all in this language. Can any wor in this language be interpreted as a string of element from S in two different ways ? Can any word in thi language have an odd total number of *a*'s? 1(

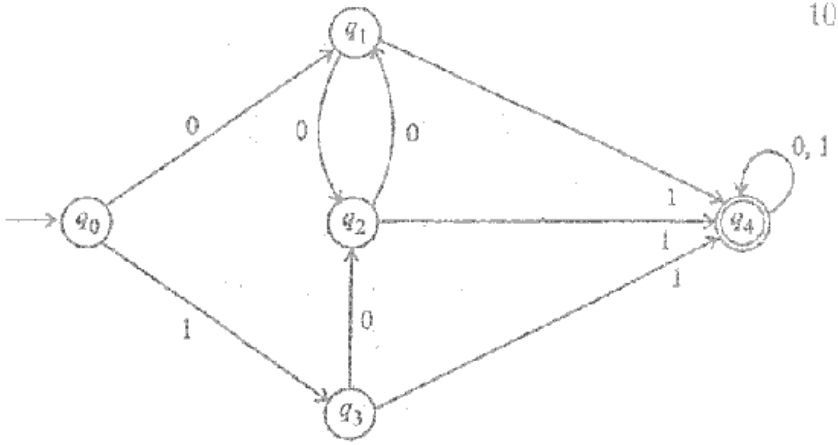
(b) Construct Dfa's for the following questions : 1(

(i) Machine that accepts all strings that have an ever length that is not divisible by 6.

(ii) Machine that accepts only those words that begir or end with a double letter.

P. T. O.

2. (a) Consider the following generalized transition graph : 10



Answer the following questions :

(i) Minimize the states in the DFA.

(ii) What is the language accepted by this graph ?

(b) Construct a Moore machine equivalent to the Mealy machine M given in table : 10

Present State	Next State			
	$a = 0$		$a = 1$	
	State	Output	State	Output
→ q_1	q_3	0	q_2	0
q_2	q_1	1	q_4	0
q_3	q_2	1	q_1	1
q_4	q_4	1	q_3	0

3. (a) Find a Regular grammar that generates the language : 5

$$L = \{w \in \{a, b\}^* ; n_a(w) + 3\, n_b(w) \text{ is even}\}$$

(b) Prove or disprove the following statement :
If L_1 and L_2 are non-regular language, then $L_1 \cup L_2$ is also non-regular. 5

(c) State and prove pumping lemma for Context-free language. 10

4. (a) Construct an *npda* that accepts the language generated by the grammar : 7

$$S \to aSSS \mid ab$$

(b) What language is accepted by the *npda* ?

$$M = (\{q_0, q_1, q_2\}, \{a, b\}, \{a, b, z\}, \delta, q_0, z\ \{q_2\})$$

with transitions : 7

$$\delta\,(q_0, a, z) = \{(q_1, a), (q_2, \lambda)\},$$
$$\delta\,(q_1, b, a) = \{(q_1, b)\},$$
$$\delta\,(q_1, b, b) = \{(q_1, b)\},$$
$$\delta\,(q_1, a, b) = \{(q_2, \lambda)\}$$

(c) Prove that family of Context-free language is not closed under Intersection and Complementation. 6

5. (a) Suppose L is accepted by a TMT. Describe how you could construct a non-deterministic TM to accept each of the following languages ? 14

(i) The set of all prefixes of element of L.

(ii) The set of all suffixes of elements of L.

(iii) The set of all substrings of elements of L.

(b) We do not define λ–transition for a TM, why not ? What feature of a TM make it unnecessary or inappropriate to talk about λ–transitions ? 6

6. (a) Convert the grammar : 5

$$S \to AB\,b \mid a$$
$$A \to aa\,A \mid B$$
$$B \to b\,A\,b$$

into Greibach normal form.

(b) Show that the following two Grammars are equivalent : 5

Grammar 1	Grammar 2
$S \to ab\,AB \mid ba$	$S \to ab\,A\,a\,A \mid ab\,Abb \mid ba$
$A \to aaa$	$A \to aaa$
$B \to a\,A \mid bb$	

(c) Prove that there exists a recursively enumerable language whose complement is not recursively enumerable. 10

7. (a) Model the following problem through petrinets : 12

(i) Semaphore for synchronization

(ii) Simplex communication protocol

(b) What do you understand by the halting problem ? Explain with the help of an example the blank-tape halting problem. 8

8. Write short notes on any *three* of the following : 20

(i) Linear Bounded Automata

(ii) Russell's Paradox

(iii) Chomskian Hierarchy

(iv) CNF

(v) Post's correspondence problems