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MCA

3rd SEMESTER EXAMINATION

THEORY OF FORMAL LANGUAGE AND AUTOMATA

PAPER—MCA-302

Full Marks : 100

Time : 3 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Answer any *five* questions. 5×14

1. (a) Define a Mealy machine with suitable example. 3

(b) Construct a Mealy machine equivalent to the Moore machine defined by the following table : 5

Present State	Next State		Output
	a = 0	a = 1	
→ q_0	q_3	q_1	0
q_1	q_1	q_2	1
q_2	q_2	q_3	0
q_3	q_3	q_0	1

(c) Find the DFA which accepts all strings over {a, b} terminating by the substring ba. 6

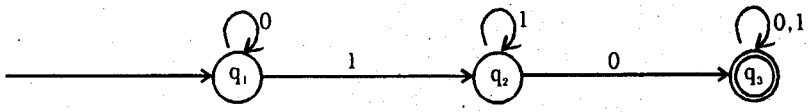
2. (a) Find a grammar generating $\{a^j b^n c^n \mid n \geq 1, j \geq 0\}$ 6

(b) What do you mean by monotonic grammar? Give examples.

(c) Consider transition system, containing ^ move.

Obtain an equivalent transition system without ^ move. 5

3. (a) Describe the set accepted by the finite automaton where transition diagram is shown below : 7



(b) State and prove Arten's theorem. 1+3

(c) Construct the finite automaton equivalent to the regular expression : 3

$$0^* (00 + 11) 1^*$$

4. (a) Define ambiguous grammar, explain with example. 4

(b) Design CFG for the set of all strings which are palindromes over an alphabet set Σ = {a, b}. 5

(c) Find an equivalent CNF for the given

$G = (\{S, A, B, D\}, \{a, b\}, P, S)$

where productions are

$S \rightarrow a^{AD}$

$A \rightarrow a^{B} / b^{AB}$

$B \rightarrow b$

$D \rightarrow$

5. (a) Find a reduced grammar equivalent to the grammar : $S \rightarrow aAa, A \rightarrow bBB, B \rightarrow ab \mid D, C \rightarrow aB, D \rightarrow EE \mid ab$. 7

(b) Construct a grammar in Greibach normal from equivalent to the grammar : 7

$S \rightarrow AA \mid a, A \rightarrow SS \mid b.$

6. (a) Prove that the family of context free language is closed under union but not closed under intersection. 6+3

(b) Construct a NPDA for the language : 6

$L = \{w \in \{a, b\}^* : n_a(w) = n_b(w)\}$

7. (a) Construct a PDA accepting the following Language : $L = \{wcw^T \mid w \in \{a, b\}^*\}$ 7

(b) Construct a PDA A equivalent to the following context free grammar :

$S \rightarrow 0BB$

$B \rightarrow 0S \mid 1S \mid 0$

Test whether 1011010 is in N(A). 4+3

8. (a) Design a Turing Machine over {1, b} which can compute a concatenation function over $\Sigma = \{1\}$. If a pair of words (w_1, w_2) is the input, the output has to be w_1w_2. 7

(b) Construct a Turing Machine that can accept the strings over {0, 1} containing even number of 1'S. 7

Internal Assessment **30**