2017

MCA

3rd Semester Examination

THEORY OF FORMAL LANGUAGES AND AUTOMATA

PAPER—MCA 302

Subject Code—32

Full Marks : 100

Time : 3 Hours

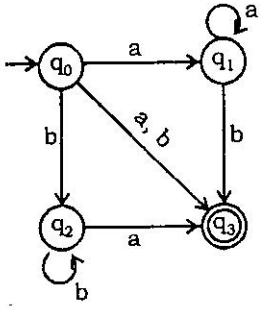
The figures in the right hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

Answer any *five* question.

1. (a) Construct a DFA equivalent to the following NFA :



(b) Construct a DFA accepting all strings over {a, b} ending with ba.

(c) Construct a transition system which can accept strings over the English alphabet set containing either *cat* or *rat*. 5+6+3

2. (a) Consider the Mealy machine described by the following table :

Present state	Next state			
	State	Output	State	Output
$\rightarrow q_1$	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

Construct a Moore machine which is equivalent to the given Mealy machine.

(b) Define Grammar. Classify Languages according to Chomsky. Define each class with suitable examples.

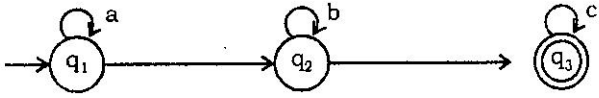
(c) Determine the type of grammar of the following production :

$AB \rightarrow BA$. 5+(1+6)+2

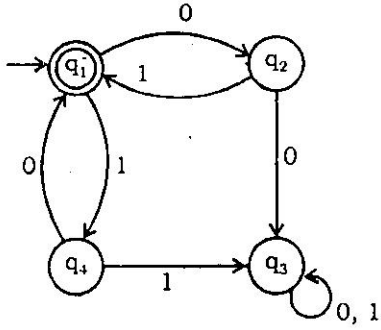
3. (a) Construct a grammar accepting
$L = \{w \in \{a, b\}^*$ the No. of a's in w is divisible by 3$\}$.

(b) Construct a grammar G accepting the set of L of all strings over {a, b} having more a's than b's. 7+7

4. (a) Consider the finite automation with null more. Obtain an equivalent automation without null more :



(b) Construct a regular expression corresponding to the state diagram described by the following figure :



(c) Construct an FA equivalent to the regular expression : $(ab + c^*)^*b$. 4+6+4

5. (a) Show that $L = \{ww \mid \in \{a, b\}^*$ is not regular.

(b) Find a reduced grammar equivalent to the grammar :

$S \rightarrow aAa \mid aE$

$A \rightarrow bBB$

$B \rightarrow ab$

$C \rightarrow aB$ 7+7

6. (a) Consider the grammar

$$S \rightarrow aS \mid AB$$
$$A \rightarrow \wedge$$
$$B \rightarrow \wedge$$
$$D \rightarrow b$$

Construct a grammar which is equivalent to the above grammar, without any null production.

(b) Define CNF. Give examples.
Reduce the following grammar to CNF :

$$S \rightarrow aAbB$$
$$A \rightarrow aA \mid a$$
$$B \rightarrow bB \mid b$$

5+(2+7)

7. (a) Reduce the grammar into Greibach Normal Form :

$$S \rightarrow SS$$
$$S \rightarrow 0S1 \mid 01$$

(b) Construct a PDA accepting $\{a^n b^m a^n \mid m, n \geq 1\}$.

7+7

8. (a) Define a Turing Machine.

(b) Design a Turing Machine to recognize the language

$$L = \{1^n 2^n 3^n \mid n \geq 1\}.$$

(c) Design a Turing machine to recognize all strings consisting of an even no. of 1's. 2+7+5

[Internal Assessment : 30 Marks]

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