PG/IIIS/MCA-302/18

MCA 3rd Semester Examination, 2018

MCA

(*Theory of Formal Languages and Automata*)

PAPER —MCA-302

Full Marks : 100

Time : 3 hours

Answer any **five** questions

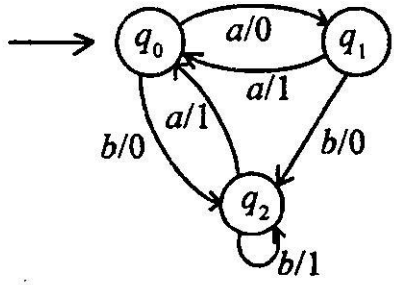
The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

1. (*a*) Define and compare Moore and Mealy machines. 2 + 2 + 2

(*b*) Convert the following Mealy machine into its equivalent Moore machine : 4



(*c*) Construct a DFA accepting all string w over $\{0, 1\}$ such that the no of 0's in w is divisible by 4 and $|w| > 0$. 4

2. (*a*) Find a grammar generating

$$\{a^j b^n c^n \mid n \geq 1, j \geq 0\}$$ 6

(*b*) Find the type of the following grammar

$$S \rightarrow Aa$$
$$A \rightarrow Ba|c$$
$$B \rightarrow aB|a$$ 2

(*c*) Find the regular expression for the set of all strings over $\{a, b\}$ containing at most 2a's. 3

(*d*) Consider the following grammar G:

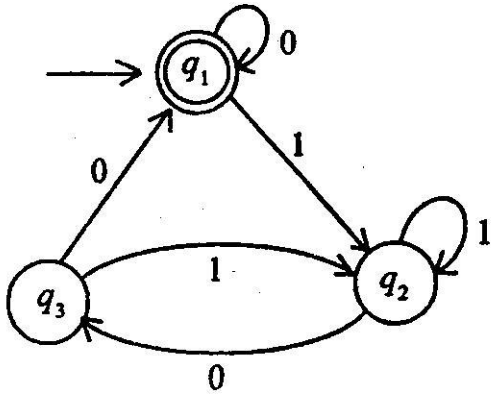
$$S \rightarrow aS|a$$

Construct a transition system accepting $L(G)$. 3

3. (*a*) Show that $L = \{a^p \mid p \text{ is prime}\}$ is not regular. 7

(*b*) Construct a regular grammar which can generate the set of all strings starting with a letter (*a* to *z*) followed by a string of letters or digits (0 to 9). 7

4. (*a*) Construct a regular expression corresponding to the following state diagram : 7



(*b*) Consider the following grammar :

$S \rightarrow 0B \mid 1A$
$A \rightarrow 0|0S|1AA$
$B \rightarrow 1 \mid 1S \mid 0BB.$

Show that the given grammar is ambiguous ? Using the reference string 00110101. 4

(*c*) Eliminate the unit production and find an equivalent grammar :

$S \rightarrow AB$
$A \rightarrow a$
$B \rightarrow C \mid b$
$C \rightarrow D$
$D \rightarrow E$
$E \rightarrow a.$ 3

5. (*a*) Find a reduced grammar equivalent to the grammar whose productions are

$S \rightarrow AB|CA$
$B \rightarrow BC|AB$
$A \rightarrow a$
$C \rightarrow aB|b.$ 7

(*b*) Reduce the following grammar to Chomsky Normal Form :

$$S \rightarrow a|b|cSS$$ 7

6. (*a*) Convert the grammar into GNF : 7

$$S \rightarrow AB$$

$$A \rightarrow BS|b$$

$$B \rightarrow SA|a$$

(*b*) Construct a PDA which accepts

$$L = \{a^n b^{2n} \mid n \geq 1\}.$$ 7

7. (*a*) Construct a PDA A equivalent to the following context free grammar

$$S \rightarrow OBB$$

$$B \rightarrow OS|1S|O$$

Test whether $0|0^4$ in $N(A)$. 4 + 3

(*b*) Design a Turing Machine that accepts

$$\{0^n 1^n \mid n \geq 1\}$$ 7

8. (*a*) Construct a Turing Machine that accepts the language $0\,1^* + 1\,0^*$. 7

(*b*) Prove that context free languages are not closed under intersection and complement operations. 7

[*Internal Assessment* : 30 Marks]
