

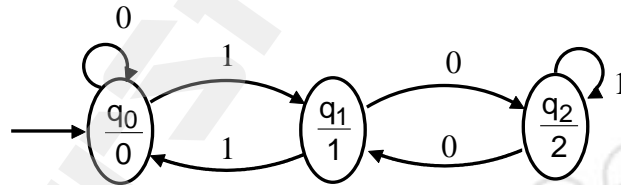


- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Assume suitable data whenever necessary.
 9. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Differentiate between NFA, E – NFA and DFA with respect to basic terminology, transition function and time required to accept the string. 7
- b) Construct minimum state DFA accepting strings over {a, b} that contains 'bbb' as substring. 7

OR

2. a) Construct minimum state DFA that accepts string over decimal digits where the decimal number is divisible by 6. (Hint: A decimal number divisible by 2 and 3 is also divisible by 6) 10
- b) Construct mealy machine equivalent to the moore machine given below 4



3. a) Find the regular expression for the finite automata shown in fig Q. 3a. 7

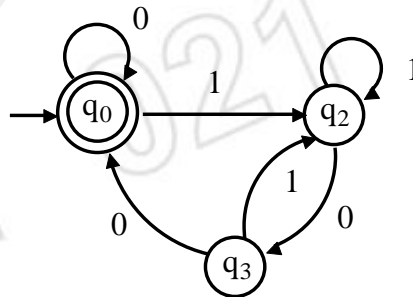


Fig. Q. 3 a

- b) Obtain the right linear grammar equivalent to the left linear grammar given below. 6
- $S \rightarrow Sab \mid Aa$
- $A \rightarrow Abb \mid bb$

OR

4. a) Explain closure properties of regular sets. 7
 b) Give the statement of pumping lemma and show the following language is not regular 6

$$L = \{a^{i^2} \mid i \geq 0\}$$

5. a) For the following grammar. 7

$$\begin{aligned} S &\rightarrow aB \mid bA \\ A &\rightarrow a \mid as \mid bAA \\ B &\rightarrow b \mid bs \mid aBB \end{aligned}$$

i) Give left most and rightmost derivation for the string babaabab.

- b) Convert the following grammar to CNF 6

$$\begin{aligned} S &\rightarrow ABa \\ A &\rightarrow aab \\ B &\rightarrow Ac \end{aligned}$$

OR

6. a) Construct the PDA for the language 7

$$L = \{a^p b^q c^r \mid p, q, r \geq 1 \text{ and } q = p - r\}$$

- b) Write a context free grammar for the language. 6

$$L = \{0^{m+n} 1^n 0^m \mid m, n \geq 1\}$$

Hence construct PDA for the CFG obtained above.

7. a) Define Turing Machine construct TM for all palindrome strings over $\{a, b\}$. i.e. 8
 palindrome strings of even as well as odd length.

- b) Give the derivation of the string $a^3 b^3 c^3$ using suitable context sensitive grammar. 6

OR

8. a) Write short note on universal Turing machine. 7

- b) Construct TM for function f , where 7

$$f(x \div y) = \begin{cases} x - y & , \quad x \geq y \\ 0 & , \quad \text{otherwise} \end{cases}$$

9. a) Show that Halting problem is unsolvable. 7

- b) Give the properties of recursive and recursively enumerable language. 6

OR

10. a) What is past correspondence problem? Is PCP solution exist for the following list? If yes give the solution. 7

	x	y
i	b	b^3
ii	bab^3	ba
iii	ba	a

- b) Define Ackermann's function and compute 6
- i) $A(1, 1)$
 - ii) $A(2, 1)$
 - iii) $A(2, 2)$

11. a) Define primitive recursive function. Show that the following function are PR functions 9

- i) $MAX(a, b)$ – returns maximum of a and b
- ii) $MIN(a, b)$ – returns minimum a of and b
- iii) $ABS(a, b)$ – returns absolute difference between a and b

- b) Write short note on unbounded minimalization. 4

OR

12. a) Write short note on Bounded minimalization. 6

- b) What is mean by Turing computable function? How it is equivalent to μ - recursive function. 7
