



- 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.

1. a) Find  $\epsilon$ -closure of all the states of given NFA. Remove  $\epsilon$ -transition from the NFA given in fig Q 1a. and produce DFA. 6

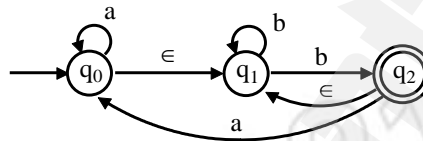


Fig. Q. 1 (a)

- b) Construct a minimum state automata accepting strings over  $\{a, b\}$  that do not contain 'bbb' as substring. 7

**OR**

2. a) Construct a Moore machine that represents 'decimal number mod 3'. Then obtain its equivalent mealy machine. 8

- b) Comment on the statement "If NFA has N states then it's equivalent DFA has maximum of  $2^N$  states". 5

3. a) Explain the chemistry hierarchy of languages. 7

- b) Construct minimum DFA for the regular expression  $ab+(b+aa) b^*a$  6

**OR**

4. a) Find the regular expression for the F. A. shown in fig Q4a 7

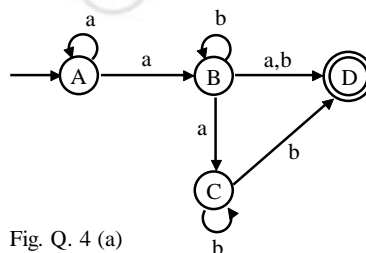


Fig. Q. 4 (a)

- b) Find equivalent right linear grammar for the left linear grammar 9 6
- $S \rightarrow Ca \mid Bb$   
 $B \rightarrow Ba \mid b$   
 $C \rightarrow Bb$

5. a) Define PDA and construct PDA for the language 7  
 $L = \{a^n b^m c^{n-m} \mid m, n \geq 1 \text{ and } n \geq m\}$
- b) Convert the following grammar to CNF 7  
 $S \rightarrow aA \mid a \mid B \mid C$   
 $A \rightarrow aB \mid \epsilon$   
 $B \rightarrow aA$   
 $C \rightarrow cCD$   
 $D \rightarrow abd$

**OR**

6. a) Construct PDA for the CFG 7  
 $S \rightarrow OS \mid ISO \mid 1$ , and show acceptance/rejection of the string 01101 (write instantaneous description)
- b) Let  $W \in L(G)$  and  $|w| = \ell$ . How long will be the derivation of  $w$ , if  $G$  is in i) CNF ii) GNF 3
- c) What is meant by ambiguous and unambiguous grammar? Explain with example. 4
7. a) Give mathematical definition of Turing machine.. construct TM for 7  
 $L = \{a^n b^n c^n \mid n \geq 1\}$
- b) Explain multitrack Turing machine with example. 6

**OR**

8. a) Define linear bounded automata. What type of language is accepted by LBA? 6
- b) Write short note on universal Turing machine. 7
9. a) Write Ackermann function. Explain with suitable example. 6
- b) Explain PCP. Is PCP solution exist for the list given in table. 7
- | i | A     | B  |
|---|-------|----|
| 1 | 1     | 11 |
| 2 | 10111 | 10 |
| 3 | 10    | 0  |

**OR**

10. a) What are the closure properties of recursive and recursively enumerable language? 7
- b) Show that Halting problem is unsolvable. 6
11. a) What is mean by primitive recursive function? 7
- b) Show that MIN (x, y), MAX (x, y) and ABS (x, y) is primitive recursive. 7

**OR**

12. a) Write short note on Bounded minimalization. 7
- b) Define  $\mu$ -recursive function. 7

\*\*\*\*\*