B.E. Fourth Semester Examination – August 2024
Finite Automata and Formal Languages

[Maximum Marks: 10

Time: 3 hrs]

Note: Answer any FIVE full questions, selecting atleast ONE full question from each Module.

Module – I

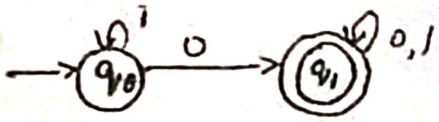
1. a) Discuss the central concepts of automata theory with example. Also differentiate between NFA and DFA. **(10 Marks)**
   b) Obtain a DFA to accept the language $L = \{w : |w| \bmod s \neq 0\}$ *on* $\Sigma = \{a\}$ and draw the transition table. **(10 Marks)**

2. a) Formally define ∈NFA and design ∈NFA to recognize keywords 'start' and 'end' **(06 Marks)**
   b) Discuss the various applications of finite automata. **(06Marks)**
   c) Obtain a DFA for the following NFA using subset construction method

(08 Marks)

Module – II

3. a) Obtain a regular expression for the languages **(06 Marks)**
   $L = \{a^{2n}b^{2m} \mid n \geq 0, m \geq 0\}$ $L = \{w : |w| \bmod 3 = 0\}$ *where* $w \varepsilon (a,b)^*\}$
   b) Obtain a regular expression for the FA shown below



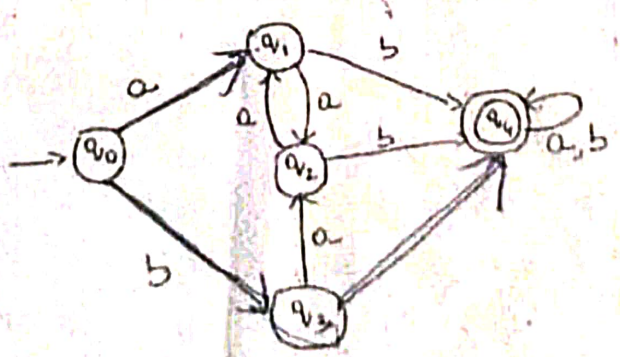
(08 Marks)

   c) Discuss the various applications of regular expressions. **(06 Marks)**

4. a) State and prove pumping lemma for regular languages. **(08 Marks)**
   b) Show that $L = \{a^{n!} \mid n \geq 0\}$ is not regular **(06 Marks)**
   c) Show that if the language L is regular, then L^R is also regular. **(06 Marks)**

Module – III

5. a) Minimize the following DFA and draw the transition table of minimized DFA. **(10 Marks)**



   b) Formally define context free grammar and explain its components. **(05 Marks)**
   c) Construct CFG for language $L = \{wcw^R \mid w \in (a,b)^*\}$ **(05 Marks)**

1641357

6. a) Discuss the following concept of context free languages with examples (06 Marks)
   i) Parse tree ii) Yield of a tree iii) Partial Parse Tree
   b) Show the following grammar is ambiguous (08 Marks)
   $S \rightarrow aSbS$
   $S \rightarrow bSaS$
   $S \rightarrow \in$
   c) Discuss the various applications of context fee grammar (06 Mark)

Module – IV

7. a) Convert the following context free grammar into chosky's normal form (CNF)
   $I \rightarrow a \mid b \mid Ia \mid Ib \mid Io \mid I1$
   $F \rightarrow I \mid (E)$
   $T \rightarrow F \mid T * F$
   $E \rightarrow T \mid E + T$ (10 Marks)
   b) Is the PDA to accept the language $L(M) = \{wCw^R\} w \in (a+b)^*$ is deterministic. (10 Marks)

8. a) Eliminate the useless symbols in the grammar
   S → aA|bB
   A → aA|a
   B → bB
   D →ab|Ea
   E → aC|d (10 Marks)
   b) Show that $L = \{a^n b^n c^n \mid n \geq 0\}$ is not context free. (10 Marks)

Module – V

9. a) Illustrate the following concepts i) Storage in the state ii) Multiple tracks (10 Marks)
   b) Design a turing machine to accept the language $L = \{0^n 1^n \mid n \geq 1\}$. Also draw the transition table. (10 Marks)

10. a) Discuss the following concepts with diagram:
    i) Simulating a TM by computers ii) Simulating a computer by a TM (10 Marks)
    b) Discuss post correspondence problem and prove the theorem posts correspondence problem is undecidable. (10 Marks)