

Exam.Code:0917
Sub. Code: 6790

1078
B.E. (Computer Science and Engineering)
Fifth Semester
CSE-505: Theory of Computation

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

- I. Write short answers of the following:
- Prove or disapprove: $(R + S)^*S = (R^*S)^*$
 - Is the grammar $S \rightarrow SS|S(S)S|\epsilon$ ambiguous? Why or why not?
 - What are recursive and recursively enumerable languages?
 - What is difference between Kleene closure and Kleene **positive** closure? Give example.
 - State the halting problem of Turing machines.

Section-A

- II.
- State pumping lemma for regular sets. Using pumping lemma, **show** that the set $\{a^n b^{2n} | n > 0\}$ is not regular.
 - Construct a minimum state automaton equivalent to DFA whose transition table is given below:

State	0	1
$\rightarrow q_1$	q ₂	q ₃
q ₂	q ₃	q ₅
q ₃ Final state	q ₄	q ₃
q ₄	q ₃	q ₅
q ₅ Final state	q ₂	q ₅

- III. Begin with the grammar:

$$\begin{aligned}
 S &\rightarrow ABC|BaB \\
 A &\rightarrow aA|BaC|aaa \\
 B &\rightarrow bBb|aD \\
 C &\rightarrow CA|AC \\
 D &\rightarrow \epsilon
 \end{aligned}$$

- Eliminate ϵ -productions.
- Eliminate any unit productions in the resulting grammar.
- Eliminate any useless symbols in the resulting grammar.
- Put the resulting grammar into Chomsky Normal Form.

IV.

- Define regular expression. Show that $(1 + 00^*1) + (1 + 00^*1)(0 + 10^*1)^*(0 + 10^*1) = 0^*1(0 + 10^*1)^*$.
- Convert the regular expression $011(0 + 1)^*$ to equivalent
 - NFA with ϵ -transitions
 - NFA without ϵ -transitions
 - DFA

Section-B

- V.
- Convert the grammar $S \rightarrow SOS^1SOS|SOSOS^1S|S^1SOSOS|\epsilon$ to a PDA that accepts the language by empty stack.
 - State the pumping lemma for Context-free languages. Using pumping lemma, show that the language $\{0^m1^n|m \neq n\}$ is not context-free.

- VI.
- Describe Turing machine model. Describe multi-tape Turing machine as an extension to the basic Turing machine. Does the multi-tape Turing machine and basic Turing-machine have same language-recognizing power? Comment.
 - Design a Push-down Automaton to accept the language $\{0^n1^m0^m1^n|m, n \geq 1\}$. Accept either by final state or empty stack.

- VII. Write short notes on:
- Tractable and intractable problems
 - Polynomial time reductions
