

INTRODUCTION TO AUTOMATA THEORY & FORMAL LANGUAGES (RCA-203)

Time: 3 HoursTotal Marks: 70SECTION - AQ-(1) Attempt all questions in brief: $2 \times 7 = 14$

(a) Define Finite Automata (FA).

(b) Give difference between NFA & DFA.

(c) Write regular expression for set of strings over $\{0,1\}$.

(d) Define Kleene closure.

(e) What is unit production?

(f) What is null production?

(g) Define Grammar.

SECTION - BQ-(2) Attempt any three of following: $7 \times 3 = 21$ (a) Use Pumping Lemma to show $L = \{a^p \mid p \text{ is a prime no.}\}$ is not regular.(b) Reduce following grammar to Chomsky Normal Form (CNF) -
 $S \rightarrow aAD; A \rightarrow aB \mid bAB; B \rightarrow b; D \rightarrow d$ (c) Find language generated by grammar
 $G = (\{S\}, \{0,1\}, \{S \rightarrow 0S1 \mid 01\}, S)$

(d) Define PDA with help of an example.

(e) Prove that language $L = \{a^n b^n c^n \mid n \geq 0\}$ is neither regular nor context free.SECTION - CQ-(3) Attempt any one part of following: $7 \times 1 = 7$ (a) Prove that for every NFA accepting a language L , there exist an equivalent DFA accepting the same language L .

(b.) Using Pumping Lemma to show that the language $L = \{a^n b^n c^n \mid n \geq 1\}$ is not a CFL.

Q-(4) Attempt any one part of following; 7x1=7

(a.) Explain Halting Problem of Turing Machine with one example.

(b.) Explain Post Correspondence Problem with example.

Q-(5) Attempt any one part of following; 7x1=7

(a.) Construct a ~~regular expression~~ transition system of finite automata equivalent to regular expression $10+(00+11)0^*1$.

(b.) Define Church's Thesis with respect to Turing Machine.

Q-(6) Attempt any one part of following; 7x1=7

(a.) Design a Turing Machine to accept language $L = \{a^n b^n \mid n \geq 1\}$.

(b.) Show that union of recursive languages is recursive.

Q-(7) Attempt any one part of following; 7x1=7

(a.) Give procedure for transforming a Mealy Machine to corresponding Moore Machine.

(b.) Explain NP-Hard & NP-Complete Problems.