

2 Attempt any two parts of the following. 10x2=20

(a) What is a regular expression? Construct a DFA for the regular expression $(00+001)^*1$.

(b) Prove that the given set of language is not regular.

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

(c) Describe the closure properties of regular languages. Prove that regular languages are closed under complementation.

3 Attempt any two parts of the following. 10x2=20

(a) Construct the context free language (CFL) for the language $\{a^n b^n \mid n \geq 0\}$.

(b) Prove that the given language L is derived from a context free grammar.

$$L = \{a^i b^j c^k \mid i, j \geq 1\}$$

(c) (i) Show that the CFG with production

$$S \rightarrow a | S a | b S S | S S b | S b S$$

is ambiguous.

(ii) Prove that every regular language is a CFL.

4 Attempt any two parts of the following. 10x2=20

(a) Define a push down automation (PDA). Describe the language of a PDA.

(b) Construct the PDA for the language $L = w c w^R | w$ in $\{a, b\}$, where R stands for reverse string.

(c) Let G be a CFG and its language is $L(G)$. How do you decide that $L(G)$ is finite?

5 Attempt any two parts of the following. 10x2=20

(a) Define a Turing machine. Construct a Turing machine for the language

$$L = \{w c w \mid \{a, b\}^*\}$$

(b) Construct a Turing machine for the integer function that computes addition of two integers, i.e., if x and y are two integers then $f(x, y) = x + y$.

(c) Define the recursive language. Do you agree that every recursive language is recursive enumerable? Justify your answer.