

- C. Explain the following terms in one or two lines (5M)
- What does the language L represented by $(11)^*$ describe?
 - What are equivalent states?
 - Find if the following statement is true or false.
"The language $L = \{a^n b^n \mid n \geq 1\}$ is context free language but not regular"
 - If G is $S \rightarrow aS \mid a$, then what is $L(G)$?
 - Prove that $A + (AB^*)B = AB^*$.

Q.2 Attempt the following: (Any THREE) (15M)

- Define Grammar. Obtain the grammar generating $\{a^n b^j c^k \mid n \geq 1, j \geq 0\}$?
- Find the deterministic acceptor equivalent to $M = (\{q_0, q_1, q_2\}, \{a, b\}, \delta, q_0, \{q_2\})$ where δ is given in the table below.

states/ Σ	a	b
$\rightarrow q_0$	q_0, q_1	q_2
q_1	q_0	q_1
q_2	?	q_0, q_1

- Briefly explain the steps of construction of minimum automaton.
- If $G = (\{S\}, \{0,1\}, \{S \rightarrow 0S1, S \rightarrow \lambda\}, S)$, find $L(G)$.
- Write a note on Chomsky Classification of Grammar.
- Write a note on operations on languages.

Attempt the following: (Any THREE) (15M)

Q.3

- What is derivation tree? Give example.
- Prove $(a+b)^* = a^*(ba)^*$. Also draw the transition system for $a^*(ba)^*$.
- Write a note on Normal forms for context free grammar.
- Define Regular Expression. Also prove that $(1 + 00^*1) + (1 + 00^*1)(0+10^*1)^*(0+10^*1) = 0^*1(0+10^*1)^*$
- State and prove Arden's theorem.
- Explain the pumping lemma for CFG.

Q.4 Attempt the following: (Any THREE) (15M)

- Write a note on the model of a linear bound automata.
- What is the halting problem of a Turing machine? Explain.
- Write a note on unsolvable problems.
- Write a note on Variants of Turing Machine.
- Design a Turing machine that accepts $\{0^n 1^n \mid n \geq 1\}$
- Write a note on halting problem of Turing Machines.

Pushdown Automaton

Q.5 Attempt the following: (Any THREE)

(15M)

- TOT
- A. Construct a DFA with reduced states equivalent to the regular expression: $10+(0+11)0^*1$
 - B. a. Null productions: Production of the form $A \rightarrow \lambda$
b. Unit productions: Production of the form $A \rightarrow B$
c. Empty string: String of length zero
d. Terminal symbols: cannot appear on left side of production, cannot be further derived....
e. Natural language: language generated by type 0 grammar.
 - C. What are ambiguous grammar? Give example.
 - D. Construct a PDA A accepting $L = \{wcw^T \mid w \in \{a,b\}^*\}$ by final state.
 - E. Define NFA. Give an example.



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Q 4 F) Please read as " Pushdown automaton (PDA) instead of " halting problem of Turing Machines ".

Q 5 B) State if the following are True Or False. (Add this instructions)

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