

INSTRUCTIONS:

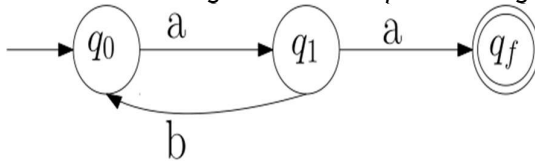
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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- Q.1(a) "If 'n' is the number of states in NFA, the maximum possible states in the corresponding DFA is n!". Justify if the statement is *correct*. Otherwise correct it. [2] CO CO2
- Q.1(b) Consider the following transition table of NFA with alphabet: $\Sigma = \{a, b\}$, states: $Q = \{q_0, q_1, q_2, q_3\}$, start state: q_0 and the accepting state: q_3 . [3] CO1

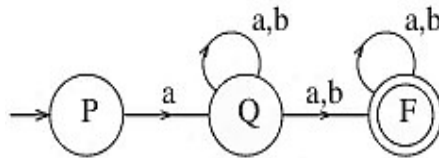
Current state	On Input symbol: 'a'	On Input symbol: 'b'
q0	q0, q1	q0
q1	q2	--
q2	q2, q3	q2
q3	q2	q1

Convert it to equivalent DFA and show the transition table of the equivalent DFA. Mark the *initial state* and *final state(s)* of the equivalent DFA.

- Q.2(a) Convert the following FA into its *equivalent* regular expression. [2] CO3



- Q.2(b) Show all possible *sequences* (paths) of *state* and the *input-symbol* to process the string: "aba" from P. For example, for $w=aab$, one path is: P-a-Q-a-Q-b-Q. Among the paths for "aba", identify the *valid paths* for accepting the string. What is the probability that the automata successfully accepts the string "aba"?



- Q.3(a) Consider the language $L = \{a^n b^n \mid 0 \leq n \leq 10 \text{ and } n \neq 5\}$. Justify your answer whether the language L is *regular* or not. [2] CO3
- Q.3(b) Formally define Mealy machine and Moore machine. Construct a Moore Machine that recognizes the string "ON" over an input sequence of characters: $\Sigma = \{O, N\}$, giving output "Luck". The machine should output "Bad Luck" otherwise. [3] CO1
- Q.4(a) The statement of the *Pumping Lemma* for regular language is stated as follows: [2] CO3
- Let $M = (Q, \Sigma, \delta, q_0, F)$ be a finite automaton with n states. Let L be a language accepted by M (L is regular) and a string $w \in L$, where $|w| \geq m$. If $m \geq n$, we can break w into substrings: x, y, z such that $w = xyz$, where $|y| \geq 0$ and $x(y)^i z$ is in L for $i > 0$.

Identify the *errors* (if any) in the Lemma and correct those.

- Q.4(b) Design regular expression to recognize the following languages over {0,1}. [3] CO3
- (i) $L = \{w \mid w \text{ consists of } \textit{at most} \text{ two } 0\text{s}\}$.
 - (ii) $L = \{w \mid w \text{ consists of } \textit{even} \text{ number of } 0\text{s} \text{ and } \textit{odd} \text{ number of } 1\text{s}\}$.
- Q.5(a) Define grammar formally with examples. What is the *limitation* of Formal grammar? [2] CO1
- Q.5(b) Construct a minimized DFA over {0, 1} that accepts all strings *ending* with “0” and the *length* of the string is even. CO2 [3]

::::16/09/2025 ::::M