

Ex/PG/MTCT/T/123A/2018

M. TECH. COMPUTER TECHNOLOGY FIRST YEAR SECOND SEMESTER EXAMINATION-2018
THEORY OF COMPUTING

Time: Three hours.

Full Marks: 100

Answer any **five** questions.

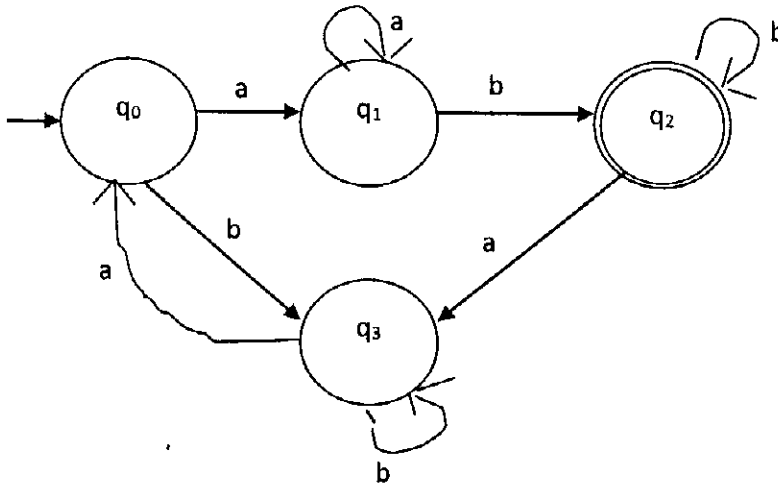
1. Design a Turing Machines for each of the following languages
 - a) Palindrome over $\{0, 1\}^*$
 - b) $L = \{0^n 1^n 2^{2n} \mid n \geq 1\}$

10 + 10
2. Construct a PDA accepting by final state for each of the following languages
 - a) $L = \{a^n b^m a^m \mid m, n \geq 1\}$
 - b) $L = \{a^n b^m \mid m > n\}$
 - c) $L = \{aw \mid w \in \{a, b\}^* : w = w^R\}$

6 + 6 + 8
3. Using pumping lemma show that the language $L = \{a^p \mid p \text{ is prime}\}$ is neither regular nor context free

10 + 10
4. Construct the minimum DFA corresponding to a language represented by $01[(10)^* + 011]^* + 0]^*1$ following a procedure. (Show all the steps)

20
5. a) Show that the grammar $S \rightarrow a|abSb|aAb, A \rightarrow bS|aAAb$ is ambiguous.
 b) For the following DFA, find an equivalent regular expression



- c) Find a regular expression for
- (i) $L = \{ab^n w \mid n \geq 3, w \in \{a, b\}^+\}$
 - (ii) $L = \{a^n b^m \mid n > 4, m \leq 3\}$

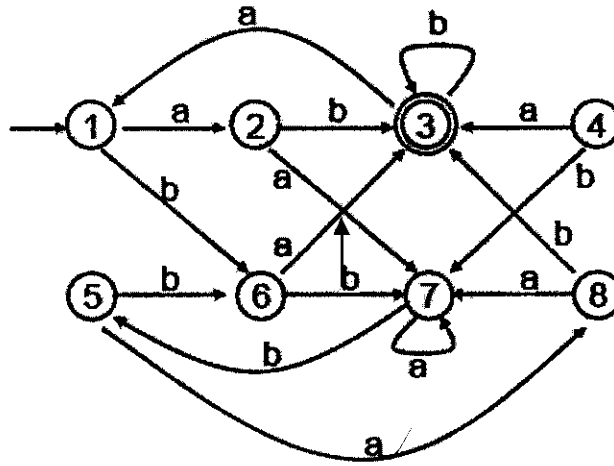
4 + 6 + (5 + 5)

Turn Over

(2)

6. a) Find the intersection of two languages over $\{a,b\}$
- all strings with at least one a
 - all strings with exactly two b 's
- b) Design a Mealy machine for modulo 5 arithmetic of positive integers represented in binary.

c) Minimize the following DFA



(6 + 6 + 8)

- 7.a) Construct Context Free Grammars with proper justification for
- $L = \{a^m b^n c^{n+m} \mid m, n \geq 1\}$
 - $L = \{w \mid n_a(w) = n_b(w)\}$
(where $n_a(w)$ means number of occurrences of symbol 'a' in string w)

b) Convert the following CFG into an equivalent PDA

$S \rightarrow Abbb/a$

$A \rightarrow aaaA/B$

$B \rightarrow bSb$

(7 + 7 + 6)

8. Prove that

- If Language L is recursive then its complement \bar{L} is also recursive.
- If Languages L and \bar{L} are Recursively Enumerable, then L is recursive.
- The intersection of Recursive and Recursively Enumerable Languages are Recursively Enumerable.
- The union of two Recursive Languages are recursive.

(4 × 5)

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