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# TCS–405/TIT–405

## B. TECH. (CS/IT)
## (FOURTH SEMESTER)
## END SEMESTER EXAMINATION, 2018
### THEORY OF COMPUTATION

**Time : Three Hours**

**Maximum Marks : 100**

**Note :** (i) This question paper contains five questions with alternative choice.

(ii) All questions are compulsory.

(iii) Instructions on how to attempt a question are mentioned against it.

(iv) Each part carries **ten** marks. Total marks assigned to each question are **twenty.**

1. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

   (a) What is Chomsky classification of languages ? Explain with suitable example.

   (b) Give CFG to represent the language L(G) with string consisting of :

   (i) At least one occurrence of 'aaa'.

   (ii) Without consecutive occurrence of 'b'.

(c) What do you mean by congruence relation ? Suppose A = {1, 2,....., 9} and ~ relation on AXA is defined by (m, n) ~ (p, q) if m + q = n + p, then prove that ~ is an equivalence relation.

2. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Construct the DFA for the string :

(i) having odd number of '0'.

(ii) having even number of '0' and even number of '1'.

(iii) having even number of '0'.

(iv) having a subword 'aba'.

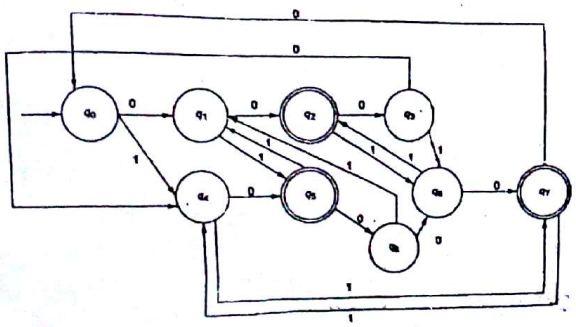
(b) Construct the NFA for the following :

(i) $L = \{a^n : n >= 0\} \cup \{b^n a : n >= 1\}$

(ii) $L = \{abab^n : n >= 0\} \cup \{aba^n : n >= 0\}$

(iii) $L = (bb^*(a + b))$

(c) Construct the DFA with minimum states for the DFA given below :



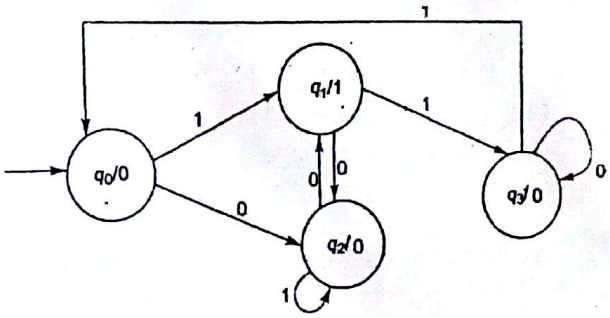




3. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) What do you mean by finite automata with output ? Explain with suitable example.

(b) Construct a Mealy machine which is equivalent to the Moore machine given as :




(c) What do you mean by regular expression ? Write the regular expression for the following :

(i) Language of strings over {a, b} that do not contain three consecutive 'a'.

(ii) Language of strings over {a, b} that contains at most three 'a'.

4. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) What is CNF and GNF ? Change the given ahead grammar into CNF :

$SS \rightarrow 1A \mid 0B$

$A \rightarrow 1AA \mid 0S \mid 0$

$B \rightarrow 0BB \mid 1$

(b) Obtain the language generated by the CFG's with the given production rule :

(i) $A \rightarrow a, A \rightarrow aB, A \rightarrow \varepsilon$

(ii) $S \rightarrow aS, S \rightarrow \varepsilon$

(iii) $A \rightarrow aS, S \rightarrow bS, S \rightarrow \varepsilon$

(iv) $S \rightarrow aS, S \rightarrow bS, S \rightarrow a$

(v) $S \rightarrow ab, S \rightarrow bS, S \rightarrow a, S \rightarrow b$

(c) What is PDA ? Design a PDA for the following language :

$$L = \{a^n b^{2n} : n > 0\}$$

5. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) What do you understand by Turing machine ? How many types of representation of Turing machine are there ?

(b) Design a Turing machine for the language $L = \{wCw^R : w \varepsilon (0 + 1)^*\}$.

(c) What do you mean by recursive and recursively enumerable language ? What are the properties of these languages ?



F. No. : a-80