G - 921 (Pages : 03) **COMP 5 - 2 (RC)**

[Total No. of Questions : 8]

T.E. (Comp.) (Semester - V) Examination, May 2011
AUTOMATA LANGUAGE AND COMPUTATIONS

Duration : 3 Hours **Total Marks : 100**

Instructions : *1) Answer any five questions, selecting at least one from each Module.*

2) Assume suitable data if, necessary.

MODULE - I

Q1) a) Is it possible to obtain an equivalent Moore machine corresponding to a Mealy machine? Justify your answer. **[5]**

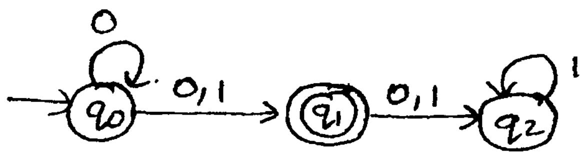
b) Draw $\in$-NFA for following regular expression. Convert the obtained $\in$-NFA to NFA. $(0 + 1)(01)^*(011)^*$. **[8]**

c) Prove using mathematical induction that for all $n \geq 0$ $5^n - 2^n$ is divisible by 3. **[5]**

d) Find regular expression for language of stungs of length one or more that contains only letters, digits and underscores (–) and begins with letter or underscore. **[2]**

Q2) a) State and prove part 1 of Kleene's theorem. **[8]**

b) Convert the following NFA to DFA. **[4]**



c) Write regular expressions for the following : **[6]**

i) Set of strings consisting of even number of a's followed by odd number of b's.

ii) Set of 0's and 1's without any consecutive 1's.

d) State pumping lemma for regular sets. **[2]**

MODULE - II

Q3) a) Obtain CFG to generate the following language. **[6]**

i) $L = \{a^n b^m \mid m > n \text{ and } n \geq 0\}$

ii) $L = \{w \mid w \in \{a, b\}^*, na(w) \neq nb(w)\}$

b) Construct a PDA for the following grammar **[6]**

$S \rightarrow aABC$

$A \rightarrow aB|a$

$B \rightarrow bA|b$

$C \rightarrow a$

P.T.O.

c) Enumerate the rules involved in constructing a CFG from a push Down Automata. **[4]**

d) Check whether the following grammar is ambigious. Justify your answer. **[4]**

$S \rightarrow aB|bA$
$A \rightarrow aS|bAA|a$
$B \rightarrow bS|aBB|b$

Q4) a) Define : **[4]**

i) Push Down Automata.
ii) Context Free Grammar.

b) Convert the following grammar to Greibach Normal form. **[8]**

$A \rightarrow BC$
$B \rightarrow CA|b$
$C \rightarrow AB|a$

c) Obtain a CFG corresponding to the following PDA. **[6]**

1. $\delta(q_0, 0, z_0) = (q_0, x\, z_0)$
2. $\delta(q_0, 0, x) = (q_0, x\, x)$
3. $\delta(q_0, 1, x) = (q_1, \in)$
4. $\delta(q_1, 1, x) = (q_1, \in)$
5. $\delta(q_1, \in, x) = (q_1, \in)$
6. $\delta(q_1, \in, z_0) = (q_1, \in)$

d) State pumping lemma for context free languages. **[2]**

MODULE - III

Q5) a) Define : **[6]**

i) Multitape Turing Machine.
ii) Non Deterministic Turing Machine.
iii) Acceptance by a Turing Machine.

b) Construct a Turing machine to accept the language. **[6]**

$L = \{w|w \text{ is even and } \Sigma = \{a, b\}\}$.

c) Explain how a universal Turing Machine is constructed. Use example to illustrate the construction. **[8]**

Q6) a) State and explain Church Turing Thesis. **[4]**

b) Construct a Turing machine to compute the function $f(x) = x + y$ where x and y are positive integers. Assume Turing Machine to use unary notation. **[6]**

c) Explain the ways to combine two Turing machines. [4]

d) Give the encoding function of a Turing machine. [6]

MODULE - IV

Q7) a) "If L_1 and L_2 are recursively enumerable languages over Σ, then $L_1 \cap L_2$ is also recursively enumerable". Prove the above statement. [8]

b) Define : [6]

i) Rice Theorem.

ii) Unsoluable Problems.

iii) Phrase structured grammar.

c) What do you mean by Enumerating a language. [2]

d) Construct a unrestucted grammar for the language $L = \{a^i\, b^i\, c^i \mid i \geq 1\}$. [4]

Q8) a) Obtain Turing machine for unrestucted grammar given below : [8]

$S \rightarrow aBS|\in$

$aB \rightarrow Ba$

$Ba \rightarrow aB$

$B \rightarrow b$

b) Define : [8]

i) Recursively enumerable language.

ii) Halting problem.

iii) Non self accepting.

iv) Context Sensitive Grammar.

c) Enumerate and explain closure properties of a context free language. [4]

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