[Total No. of Questions : 8]

T.E. (COMP.) (Semester - V) (RC) Examination, Nov. / Dec. - 2011

AUTOMATA LANGUAGES & COMPUTATION

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

Instructions : 1) Answer any five questions and at least one from each Module.

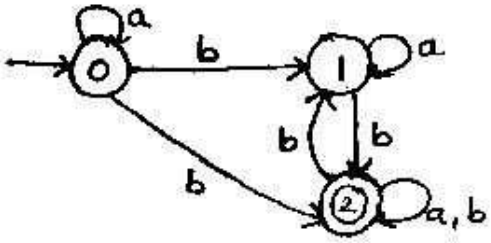
2) Make suitable asssumptions wherever necessary.

MODULE - I

Q1) a) State Mathematical Induction. Prove the following using Mathematical Induction

$$\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$$ **[6]**

b) Convert the following Non Deterministics Finite Automata to Deterministics Finite Automata. **[6]**

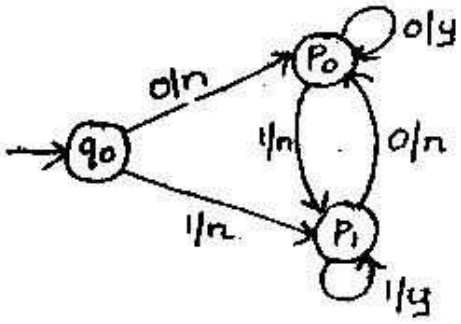


c) Define :

i) Non Deterministic Finite Automata.

ii) Proof and Give its classification. **[4]**

d) Convert the following Mealy machine to Moore machine **[4]**



P.T.O.

Q2) a) State pumping lemma. [6]

Using pumping lemma prove that $L=\{a^i b^i | i \geq 0\}$ is not regular.

b) Obtain a regular expression to accept the following strings over $\Sigma=\{a,b\}$ [4]

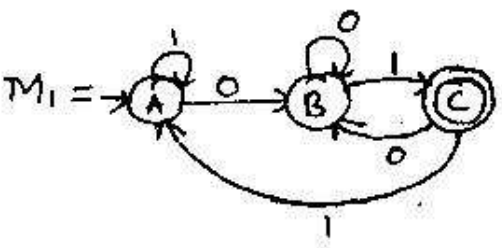
i) Starting with *a* and ending with *b*.

ii) Strings of a's and b's with alternate a's and b's.

c) Construct a $\in$ - NFA to accept the following regular expressions

i) (0 + 1)* (00 + 11) (0 +1)*

ii) (a + b) aba (a + b)* [6]

d) Let $M_1 =$ 

$M_2 =$ 

find

i) $L_1 - L_2$ where M_1 accepts L_1 & M_2 accepts L_2 respectively. [4]

MODULE - II

Q3) a) Construct a PDA to accept the following Language $L=\{a^n b^{2n} | n \geq 1\}$ Explain the behaviour of the above PDA with the help of a string. [8]

b) Define Chomsky Normal Form. [2]

c) Eliminate the useless symbols from the grammer

S → aA | bB

A → aA | a

B → bB

D → ab | Ea

E → ac | d [4]

d) Show that the following Language is not context free language $L=\{a^i b^i c^i | i \geq 1\}$. [6]

Q4) a) Convert the following grammer into Greibach Normal form

S → ABC | BaB

A → aA | BaC | aaa

B → bBb | a

C → CA | AC [8]

b) Eliminate left Recursion and factor the following grammer [4]

$S \rightarrow S_1$

$S_1 \rightarrow S_1T \mid ab$

$T \rightarrow aTbb \mid ab$

c) Construct a bottom up PDA for the following [6]

$S \rightarrow S + T$

$S \rightarrow T$

$T \rightarrow T * a$

$T \rightarrow a$ [2]

d) Define Push Down Automata.

MODULE - III

Q5) a) Give the variations of the Turing machine. [8]

b) Construct a Turing machine to accept the Language $L = \{w \mid w \in \{0+1\}^*\}$ containing the substring 001. [6]

c) What do you mean by computing a partial function with a turing machine. Explain with the help of an example. [6]

Q6) a) Explain how will you combine two turing machines. [6]

b) Obtain a turing machine that computes n mod 2, replaces input string by the output of the operation. [6]

c) Give the encoding function for a universal turing machine. [6]

d) Why a Turing machine is said to be a language acceptor. [2]

MODULE - IV

Q7) a) "For any unrestricted grammer G = (V, Σ, S, P) there is a Turing machine T = (Q, Σ, T, q0, δ) with L(T) = L(G)". Justify this statement. [8]

b) What do you mean by enumerating a language by a Turing machine. [4]

c) Construct an context sensitive grammer for the following language $L = \{a^n b^n a^{2n} \mid n \geq 1\}$. [6]

d) Define Non self accepting. [2]

Q8) a) Describe the language generated by the unrestricted grammer with the productions given below [8]

i) $S \rightarrow ABCS / ABC$

$AB \rightarrow BA, AC \rightarrow CA, BC \rightarrow CB$

$BA \rightarrow AB, CA \rightarrow AC, CB \rightarrow BC$

$A \rightarrow a, B \rightarrow b, C \rightarrow c.$

ii) $S \rightarrow LaR, L \rightarrow LD|\in, Da \rightarrow aaD, DR \rightarrow R, R \rightarrow \in.$

b) Define [6]

i) Context Sensitive Grammer.

ii) Rice Theorem.

iii) Unrestricted Grammer.

c) Explain the relationship among different class of languages in Chomsky hierarchy. [4]

d) Define Generalized sequential machine. [2]

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