Printed Pages—4 **EIT072**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2754 Roll No.

B. Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2013-14

THEORY OF AUTOMATA AND FORMAL LANGUAGES

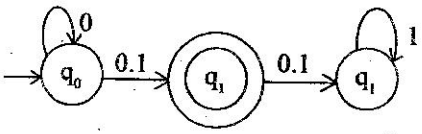
Time : 3 Hours *Total Marks : 100*

1. Attempt any **four** parts : **(5×4=20)**

(a) What is Formal Languages and difference between NFA and DFA ?

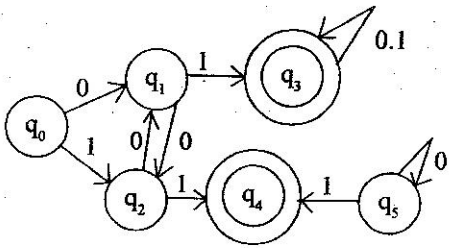
(b) Design DFA and NFA of L = {a^n * b : n > = 0}.

(c) Convert the NFA in figure into an equivalent deterministic machine.



(d) Construct minimal DFA that accepts all strings of 'a' and 'b' that contain even number of a's and even number of b's.

(e) Minimize the no. of states of DFA which is shown in figure :



(f) What is finite automata and which type of Language accept by finite automata ?

(i) If $\Sigma = \{a, b\}$

find :

(i) Σ^*

(ii) $\Sigma+$

(ii) If $L = \{a^n * b^n : n >= 0\}$

find :

(i) L^R

(ii) L^2

(iii) Complement of L.

2. Attempt any **two** parts : **(10×2=20)**

(a) What is pumping lemma for regular Language and using pumping lemma show that $L = \{ww^R : w = \{a, b\}^*\}$ is not Regular.

(b) (i) Give an NFA that accepts the language

$$L((a + b)^* b(a + bb)^*).$$

(ii) Find DFA that accepts the language $L(aa^* + aba^*b^*)$.

(c) (i) What is right linear grammar and left linear grammar ?

(ii) If L1 and L2 are regular languages then L1UL2 is regular or not, if regular then prove and not regular then also prove.

(iii) Discuss the closure properties of regular language under set operations.

3. Attempt any **two** parts : **(10×2=20)**

(a) What is CFG and draw the CFG for that Languages :

(i) $L = \{a^n * b^m * c^m d^n : n, m >= 1\}$

(ii) $L = \{a^m * b^n * c^p * d^q\}$ with $m + n = p + q$.

(b) Explain Chomsky normal form and Greibach normal form.

(i) Convert the grammar $S \rightarrow abSb \mid aa$ into Greibach normal form

(ii) Convert the grammar with productions :

$S \rightarrow ABa$

$A \rightarrow aab$

$B \rightarrow Ac$ to Chomsky normal form.

(c) What is the pumping lemma for context free languages and using pumping lemma show that the language $L = \{a^{n!} : n >= 0\}$ is not context free.

4. Attempt any **two** parts : **(10×2=20)**

(a) (i) What is the difference between deterministic pushdown automation and non-deterministic pushdown automation ?

(ii) Construct the npda's that accept the languages :

(a) $L = \{a \wedge n * b \wedge 2n : n >= 0\}$

(b) $L = \{ww \wedge R : w = \{a, b\}^+\}$

(b) Construct a pda that accepts the language generated by grammar with productions :

(i) $S \rightarrow aSbb \mid a$

(ii) $S \rightarrow aA$

$A \rightarrow aABC \mid bB \mid a$

$B \rightarrow b$

$C \rightarrow c$

(c) Show that the languages are deterministic context-free languages :

(a) $L = \{a \wedge n * b \wedge n : n >= 1\} \cup \{a\}$

(b) $L = \{w = \{a, b\}^* : Na(W)$ and $Nb(w)$ does not equal$\}$.

5. Attempt any **four** parts : **(5×4=20)**

(a) What is turing machine ? Design a turing machine with no more than three states that accepts the language $L(a(a + b)^*)$. Assume that $\Sigma = \{a, b\}$.

(b) What is the difference between recursive and recursive enumerable language ?

(c) Given two positive integers x and y, design turing machine that compute x + y.

(d) Discuss halting problem and post correspondence problem.

(e) Design turing machine that accepts :

$L = \{a^n * b^n : n >= 1\}$.

(f) Construct a turing machine to compute the function $f(w) = W^R$, where $w = \{0, 1\}^+$.