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

PAPER ID : 0112 Roll No. | | | | | | | | | | |

B.Tech.

(SEMESTER-IV) THEORY EXAMINATION, 2012-13

THEORY OF AUTOMATA & FORMAL LANGUAGES

Time : 3 Hours] *[Total Marks : 100*

SECTION – A

1. Attempt **all** question parts : **10 × 2 = 20**

(a) Draw the model diagram for finite automata and pushdown automata.

(b) What is the role of finite automata for searching a keyword in documents ?

(c) Write Regular Expression for the following languages :

(i) Set of all strings such that the number of 0's is odd

(ii) Set of all strings that do not contain 1101 as a substring

(d) Design CFG for the language consisting of all strings of even length over {a, b}.

(e) Briefly write about Church-Turing thesis with a neat diagram.

(f) What is Moore and Mealy machine ?

(g) Convert the given CFG into PDA by empty stack :

G : $S \rightarrow AB \mid a$

$A \rightarrow SaS \mid \epsilon$

$B \rightarrow b$

(h) Define the languages generated by Turing Machine.

(i) State whether the following instances of PCP has a solution. Justify.

Top = (10, 011, 101) Bottom = (101, 11, 011)

(j) Show that φ^* is ϵ by constructing its NFA using Thomson's method.

SECTION – B

2. Attempt any **three** question parts : $3 \times 10 = 30$

(a) (i) Explain in detail about various models of Turing Machine.

(ii) State halting problem. Prove that "$HALT_{TM}$ is undecidable".

(b) Convert the following given Non-deterministic finite automata into minimized Deterministic finite automata.

Given NFA :

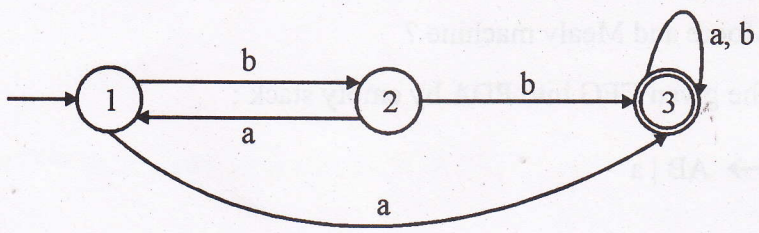
States/Input	A	B
→p	{q, s}	{q}
*q	{r}	{q, r}
r	{s}	{p}
*s	-	{p}

(c) Define Inference, Derivation and Syntax tree. Consider the context free grammar G:P → 0P0 | 1P1 | Є and build derivation, syntax tree and inference for the string 0110 using grammar G.

(d) Construct Pushdown automata for the language L = { ww^R | w is in (0 + 1)*}. Give instantaneous description of the input 1111.

(e) Consider the following DFA and find its equivalent regular expression using Rij method.

Given DFA :



SECTION – C

Attempt **all** questions : $5 \times 10 = 50$

3. Attempt any **two** parts : $2 \times 5 = 10$

(a) Draw NFA- Є transition diagram for the following regular expressions :

(i) ((ab)*/b)a

(ii) (0* / 1*)*10

(b) Write an algorithm to minimize the given DFA using subset construction method.

(c) Construct DFA that accepts set of natural numbers which are divisible by 3.

4. Attempt any **one** part : **1 × 10 = 10**

(a) State pumping lemma. Prove that the language consisting of "set of all strings over {a} whose length is prime" is not regular.

(b) Illustrate in detail about all the closure properties of regular languages.

5. Attempt any **one** part : **1 × 10 = 10**

(a) Write down the steps required to convert CFG into Chomsky Normal Form. Consider the following CFG and find its equivalent CNF and GNF.

G : $S \rightarrow ASB \mid \epsilon$

$A \rightarrow aAS \mid a$

$B \rightarrow SbS \mid A \mid bb$

(b) How to eliminate useless symbols and unit productions in a grammar ?

Eliminate unit productions for the following CFG :

G : $E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow (E) \mid I$

$I \rightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$

6. Attempt any **one** part : **1 × 10 = 10**

(a) Prove that "Language L has a PDA that accepts it by final state if L has a PDA that accepts it by empty stack".

(b) Find equivalent CFG of the following given PDA :

PDA $P = (\{q0, q1\}, \{a, b\}, \{a, Z_0\}, \delta, q0, Z_0)$

Where δ :

$\delta(q0, a, Z_0) = (q0, aZ_0)$

$\delta(q0, a, a) = (q1, aa)$

$\delta(q1, a, a) = (q1, \epsilon)$

$\delta(q1, \epsilon, Z_0) = (q1, \epsilon)$

7. Attempt any **two** parts : **2 × 5 = 10**

(a) State Post Correspondence Problem and prove that "PCP is undecidable".

(b) Design transition diagram for the language $L = \{a^i b^j c^k \mid i, j > 0 \text{ and } k = i*j\}$ using Turing Machine.

(c) Prove that "Every language defined by a regular expression is also defined by a finite automation".
