Printed Pages: 03 **Sub Code: RCS403**

Paper Id: 110433 **Roll No.**

B. TECH
(SEM IV) THEORY EXAMINATION 2017-18
THEORY OF AUTOMATA AND FORMAL LANGUAGES

Time: 3 Hours ***Total Marks: 70***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. Define alphabet, string and language.
b. Design a regular expression that accepts all the strings for input alphabet {a,b} containing exactly 2 a's.
c. Design a NFA that accepts all the strings for input alphabet {a,b} containing the substring abba.
d. Define Chomsky hierarchy.
e. Is context free language closed under union? If yes, give an example.
f. Convert NFA into equivalent DFA by taking any suitable example.
g. Remove useless productions from the given productions: S→AB|ab, A→aA|B|a, B→D|E

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. Define Deterministic Finite Automata (DFA) and design a DFA that accepts the binary number whose equivalent is divisible by 5.
b. State recursive definition of regular expression and construct a regularexpression corresponding to the state transition diagram as shown in Fig.1

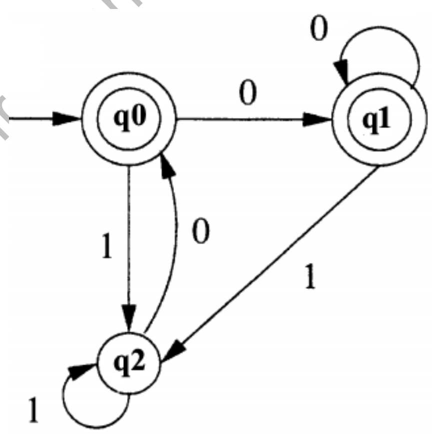

Fig.1

c. Reduce the given grammar G=({S,A,B},{a,b},P,S) to Chomsky Normal Form. Where P is defined as:

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

d. What is Push Down Automata (PDA)? Design the PDA for the language $L = \{wcw^R \mid w \in \{a,b\}^*\}$
e. Define Turing Machine (TM). Construct the TM for the language $L = \{a^n b^n \mid n>0\}$.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Describe Mealy and Moore machines with example. Convert the given Mealy machine as shown in Fig. 2 into Moore Machine.

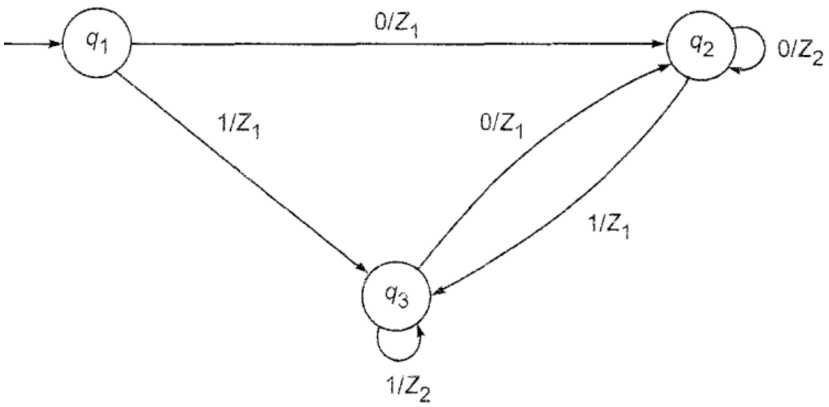

Fig. 2

(b) Construct the minimum state automata equivalent to DFA described by Fig. 3

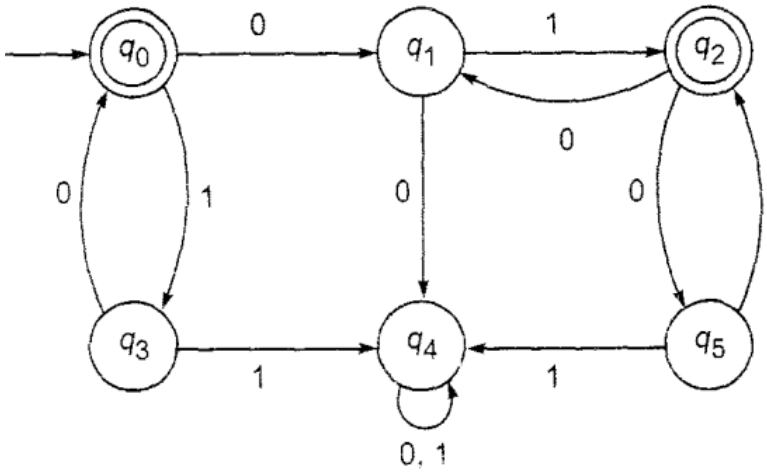

Fig. 3

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) State Pumping Lemma for regular sets. Show that the set L={a^p| p is a prime} is not regular.

(b) Discuss closure properties i.e. concatenation, union, intersection, complement of regular languages.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) Discuss inherent ambiguity of context free languages with suitable example. Construct the context free grammar that accepts language L={$a^ib^jc^k$| i = j or j = k; i, j, k are positive integers}.

(b) Define parse tree. Find parse tree for the string *abbcde* considering the productions-

S→aAcBe
A→Ab
A→b
B→d

Is this ambiguous? Justify.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Differentiate between deterministic PDA (DPDA) and non-deterministic PDA (NPDA) with suitable example. Also discuss two stack PDA with example.

(b) Construct a PDA equivalent to the following CFG productions:

$$S \rightarrow aAA, \quad A \rightarrow aS \mid bS \mid a$$

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write short notes on the following:
  - (i) Halting problem of Turing machine
  - (ii) Recursive Language
  - (iii) Variants of Turing Machine

(b) Define Post's Correspondence Problem (PCP) and Modified PCP with its applications. Find any three PCP solutions of the lists $x=(b,bab^3,ba)$ and $y=(b^3,ba,a)$.