DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY

B.TECH. SEMESTER V [Information Technology]

SUBJECT: (IT 511) Theory of Automata and Formal Language

Examination	**: First Sessional**	**Seat No.**	**:**
Date	**: 01/08/2016**	**Day**	**:Monday**
Time	**: 11:30 to 12:45**	**Max. Marks**	**: 36**

INSTRUCTIONS:

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

Q.1 Do as directed. **[12]**

(a) Consider the language L = (a+b)* b (a+ab)*. How many strings are there of length ***less than 3*** in L? List out all the strings following the given criteria. **[02]**

(b) 1) from following which is describing Transition function of DFA **[02]**

i) Σ * Q-> Σ ii) Q * Q-> Σ iii) Σ * Σ->Q iv) Q * Σ -> Q

2) Which of the following is true?

i) Union of two regular languages is regular language
ii) union of one regular and one non regular language is always regular language
iii) Union of two non regular languages is regular language
iv)None of above is true

(c) Consider the set 'S' having elements:- {1, 2, 3} Two relations R1 and R2 are given on the set S . **[02]**

Find out whether the relations are :- reflexivity, symmetry, transitivity.

I. R1 = {(2,3), (3,1), (1,1)}

II. R2 = {(1,1), (2,2), (3,3), (1,2)}

(d) Below are given some regular expressions representing some languages and some language descriptions, using common english. Match the best description with the regular expressions. **[02]**

Regular expression	Language description
(11)∗	Strings that begins with zero or more ones followed by zero or more zeroes.
1∗0∗	Strings consisting only of ones and which lengths are even
(0∗10∗10∗)∗	An arbitrary number of repetitions of a string consisting of two 1's and an arbitrary number of zeroes in arbitrary positions.
1∗01∗	Strings that must contain a zero

(e) Which of the following strings are accepted by following regular expressions **[02]**

Strings : (1) aaabb (2)a (3)aba (4)ba (5)aa (6)abababaa (7) ababa

RE:- (1) a* b* (2) a(ba)*a

(f) Prove using mathematical induction that for every nonnegative integer 'n', **[02]**

$$\sum_{i=1}^{n} \frac{1}{i(i+1)} = \frac{n}{n+1}$$

(If n=0, the sum on the left is 0 by definition.)

Q.2 Attempt Any Two of following questions. **[12]**

(a) Minimize the Finite Automata given in figure1. **[06]**

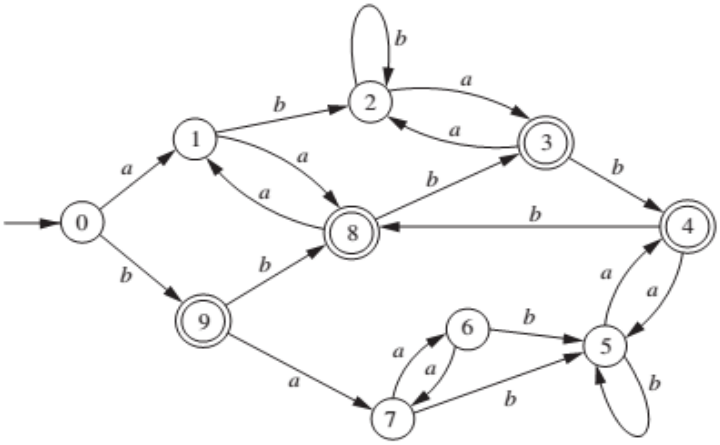

figure-1

(b) Let M1 and M2 be the FAs as given in following figure2, accepting languages L1 and L2, respectively. **[06]**

Draw FAs accepting the following languages.

a. L1∪ L2

b. L1∩L2

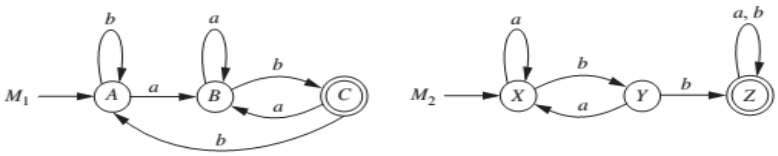

Figure-2

(c) Prove that, for every alphabet ∑ , every regular language over ∑ can be accepted by a finite automaton (Kleene's Theorem, Part1) **[06]**

Q.3 Attempt following questions **[12]**

(a) Find the equivalent NFA of the following NFA-∧ given in figure3. **[06]**

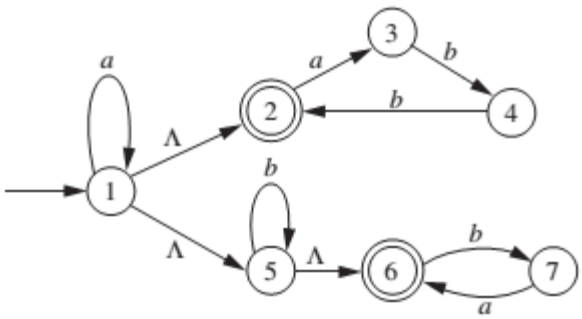

Figure-3

(b) Draw the NFA-∧ for the regular expression - ((11)*0 + (10)* 1*)* **[06]**

OR

Q.3 **[12]**

(a) Draw the DFA which accept the language L={x∈{a, b}*| Number of a' is divisible by **3** and start with **b** } **[03]**

(b) Construct the DFA which accepts strings over {a, b}* containing either ***ab*** or ***bba*** as substring. **[03]**

(c) Find the equivalent DFA of the following NFA given in figure4. **[06]**

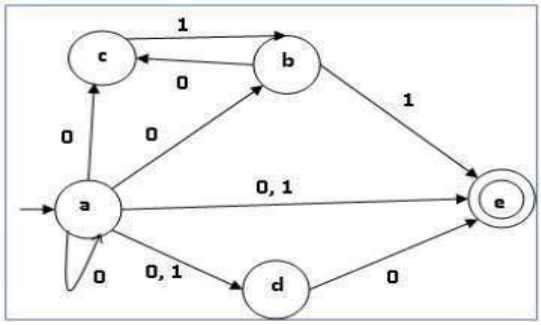

Figure-4