4. a) State and prove the pumping lemma for languages accepted by a DFA.

   Explain if the converse of this result is true.

   b) Find out if the language $\{ww^R x : w \in \{a,b\}^+, x \in \{a,b\}^*\}$ can be accepted by a deterministic finite automata. 12+8

5. a) Let L be a language accepted by a nondeterministic finite automata M. If the final states of M are interchanged with the nonfinal states of M, explain what will be the language accepted by M.

   b) Prove that if L is accepted by a DFA, then its reverse L^R is accepted by a NDFA.

   c) Construct a NDFA which accepts all strings of a, b, where at least one of the last three symbols is a. Give correctness proof. 5+7+8

6. a) Explain the concept of $\in$ - closure of a set of states of a NDFA.

   b) Prove that for each NDFA, there exists an equivalent DFA. 4+16

7. a) Consider the language L = { all strings of a,b where at least one pair of a's is separated by a substring of even length} Construct a NDFA for L with necessary justifications.

   b) Construct a DFA for L with minimum number of states and compare the number of states of the DFA for L with these of the NDFA. 10+10

————————×————————

BACHELOR OF COMP.SC. ENGINEERING EXAMINATION, 2010

(4th Year, Final, 1st Semester)

FORMAL LANGUAGE & AUTOMATA THEORY

Time : Three hours Full Marks : 100

Use a separate Answer - Script for each part.

Answer any ***five*** questions.

1. a) Construct a DFA which accepts all binary strings whose reverse when interpreted as a unsigned integer represents a number divisible by 5.

   b) Construct a DFA which accepts all strings of a, b where the absolute value of the difference between the number of a's and b's is divisible by 3. Give justifications of your construction. 10+10

2. a) Prove that every finite set is acceptabe by a Deterministic Finite Automata.

   b) Let L be a language accepted by a DFA. Let L´ be the language obtained by deleting the last symbol of every string of L. Find out if it is possible to construct a DFA accepting L´. 10+10

3. a) Describe an algorithm for determination of the set of states reachable from a given set of states of a DFA. Prove its correctness.

   b) Hence find out how far a given DFA M, it may be determined whether $L(M) = \Sigma^*$ where Σ is the alphabet of M, 15+5