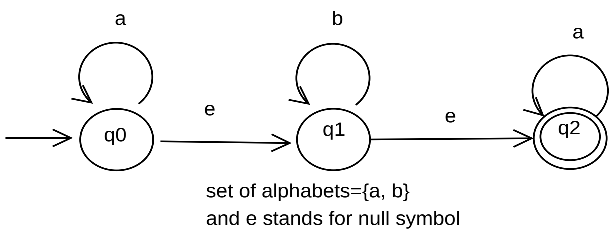
Master of Engineering(CSE), 1st Semester, 2012-13

Theory of Formal Languages
Assignment # 1

1. Show that rational numbers are countable.
2. Prove the following:
   (a) $L\phi = \phi$
   (b) $L\{\varepsilon\} = L$
   (c) $L^+ = L^*L$
   (d) $L^*L^* = L^*$
3. Let L is language over Σ; and $L^R = \{w^R | w \in L\}$. For each of the following prove equalities or give counter example.
   (a) $(S \cup T)^R = S^R \cup T^R$
   (b) $(ST)^R = T^R S^R$
   (c) $(S \cup T)^* = S^* \cup T^*$
   (d) $A^* = B^*$ imply that $A = B$.
4. Let $L_K = \{a, a^2, \ldots, a^k\}$. How many elements are there in L_k^2?
5. Construct the *DFA* for $L = \{w \in \{a,b\}^* | w$ ends with $abb\}$.
6. Show that if L is regular then L^R is regular.
7. Suppose L is language over one letter alphabet and $L = L^*$. Show that L is regular.
8. How many distinct *DFAs* are there on a given set of n states over an alphabet with $k-$ letters?
9. Prove or disprove the following statements. If false, provide counter example.
   (a) If $L_1 \cup L_2$ is regular, then either L_1or L_2 is regular.
   (b) If $L_1 L_2$ is regular then either L_1 or L_2 is regular.
   (c) If L^* is regular then L is regular.
10. Convert the following *NFA* into *DFA*.



11. Prove the kleene's theorem. (The regular languages are closed on union, concatenation, and Kleen star).

12. Using the Pumping Lemma show that following languages are not regular.

    (a) $L = \{a^n b^n | n \geq 0\}$

    (b) $L = \{a^p | p \text{ is prime }\}$

    (c) $L = \{ww | w \in \{a,b\}^*\}$

13. Give an example of a Production which is both of Regular Grammar as well as Context-Free Grammar.

14. Construct a *PDA* which recognizes the language $L = \{wcw^R | w \in \{a,b\}^*\}$, and $\Sigma = \{a,b,c\}$.

    Submission deadline: 14-12-12, Format and paper: A4, plain paper, with solution sheets stapled together.