# Tutorial 3

1. Given a language L aver an alphabet Σ, the reverse of a language is the set of words which, if their letters were reversed, would give words in L. Prove that if L is a regular language then so is the reverse of L.

Proof:

Given that L is a regular language then there must exists a FINITE AUTOMATA M such that L(M)=L. The reverse of L is also a regular language as demonstrated above.

It is possible to create a FINITE AUTOMATA N such that L(N) = reverse of L in the following way:

* 1. Set the starting state(s) of M as final state(s) of N
  2. Set the final state(s) of M as starting state(s) of N
  3. Reverse the transition function of M. That is if δM(a,b)=c then δN(c,b)=a

Naturally, the states of N are the same as the states of M and they have the same input alphabet.

1. Show that any finite language is regular.

**Proof:**

Given that a set is finite and its size is n then it is possible to create n FINITE AUTOMATAS that accept exactly only one string inside the set. Thus, we obtain a NONDETERMINISTIC FINITE AUTOMATA N which just comprises the n FINITE AUTOMATAS. M is a NONDETERMINISTIC FINTE AUTOMATA because there are multiple starting states. Since, the set is finite then M will contain only a finite number of states.

**Another proof:**

Let L be a finite language. Let L = {w1, w2, . . . , wn}, for some n ∈ N. Then, it is easy to see that L(α) = L where α is the regular expression w1 + w2 + . . . + wn. Since we have shown that for any regular expression α there is finite automaton M such that L(α) = L(M), we have that L is regular.