Weekly Proof Questions (Sections 3.1 – 3.3)
Assigned: 2/24/2015
Due: 2/26/2015

1) Give the sequence of configurations that the Turing machine M_2 in chapter 3 of the text (and shown in class) goes through while reading in the three following strings:

a) 000
b) 0000
c) 000000

2) What is the flaw in the following proof to show that if a language L is Turing recognizable, then we can create an enumerator to enumerate it? Remember that the sequence s_1, s_2, s_3, …, is an enumerated list of all strings in Σ^*, from shortest to longest, in lexicographical order for all strings of the same length.

Let M be a Turing machine that recognizes L.

We can create an enumerator E for L as follows:

1. Repeat the following for i = 1, 2, 3, …
2. Run M on s_i.
3. If it accepts, print out s_i.

3) A Turing machines with a stay option is similar to an ordinary Turning machine except that the transition function has the form:

$$\delta: Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R, S\}$$

If $\delta(q, a) = (r, b, S)$, when the machine is in state q reading an a, the machine's head stays exactly where it is. Show that Turing machines with a stay option recognize the class of Turing-recognizable languages.

4) Show that Turing-decidable languages are closed under the following operations:

a) union
b) intersection
c) complementation
d) concatenation

5) Show that Turing-recognizable languages are closed under union and intersection. Why is it necessary to be more clever with these two proofs than those in question number 3?