LING 106: Homework 7

Due: November 21, 2007

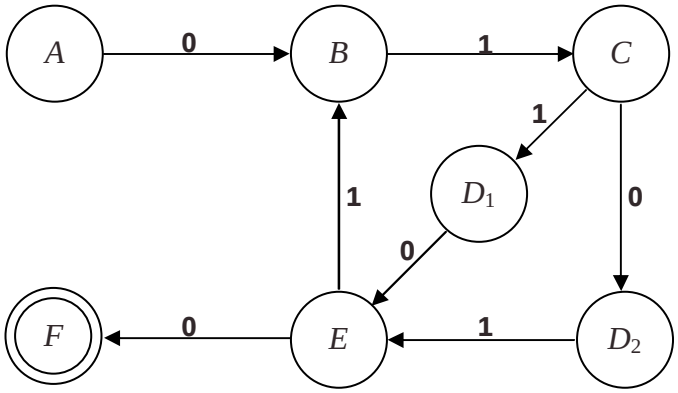
1. THE PUMPING LEMMA IN REGULAR LANGUAGES

The following language is regular. This means that it is possible to (a) draw a corresponding FSA diagram and (b) show that it obeys the Pumping Lemma for the indicated strings. Since it's possible to do (a) and (b), go ahead and do them. Assume that the pumping length for *L* is 6.

> *L* = {*w* | *w* contains the substring **011** exactly once}, Σ = {**0**, **1**}
> Strings in *L*: **011000**, **1111111011**, **0101101**

2. THE PUMPING LEMMA AND FSAS

Consider the following FSA (start state: *A*).



You don't need to determine what the language *L* is that this FSA models. Take a moment to verify for yourself the following two facts:

$|L| = \infty$ $M \subseteq L$, where M = {**01010**, **011011010**, **010111100**}

Now, answer the following questions:

1. *L* is a regular language. Therefore, according to the Pumping Lemma, there's some number *p* such that a pumpable, nonempty substring can be found in the first *p* symbols of the string. Of course, it doesn't tell us what *p* is; it could be 4, or it could be 400.

   The smallest possible *p* for Language *L* is 9. (Of course, any $p > 9$ will work: if a pumpable substring can be found in the first 9 symbols, then one can be found in the first 10 symbols, the first 900, etc.)

   Explain how we can tell that $p = 9$ from the machine.

2. Show that each string in *M* follows the Pumping Lemma ($p = 9$).

3. IDENTIFYING REGULAR LANGUAGES

For each of the following languages, either demonstrate that it is regular, or demonstrate that it is not.

a. $A = \mathtt{01}^n\mathtt{01}^n\mathtt{0}^n$, where $n \geq 0$
b. $B = \mathtt{01}^*\mathtt{01}^*\mathtt{0}^*$
c. $C = \mathtt{1}^*\mathtt{0}^n\mathtt{1}^{2n}$, where $n \geq 0$
d. $D = \mathtt{0}^n\mathtt{1}^m$, where $n > m - 2$