# CS 3530: Assignment 3c

Fall 2014

# Problems

## Problem 1.54 (20 points)

### Problem

Consider the language $F = \{a^i b^j c^k : i, j, k \geq 0 \text{ and if } i = 1 \text{ then } j = k\}$.

**a.** Show that $F$ is not regular.

**b.** Show that $F$ acts like a regular language in the pumping lemma. In other words, give a pumping length $p$ and demonstrate that $F$ satisfies the three conditions of the pumping lemma for this value of $p$.

**c.** Explain why parts (a) and (b) do not contradict the pumping lemma.

### Solution a

Assume F is regular
string s $= ab^p c^p$
split s into s $=$ xyz where:
1. xy$^i$z $\in$ F(for each $i \geq 0$)
2. $|y| > 0$
3. $|xy| \leq$ p

If we make x=ab$^p$ and y $= c^p$ and z $= \varepsilon$ for some $i \leq p - 1$ than xy$^i$z $= ab^p c^{p+i} \notin$ F.

### Solution b

Assume F is regular
string s $= ab^p c^p$
split s into s $=$ xyz where:
1. xy$^i$z $\in$ F(for each $i \geq 0$)
2. $|y| > 0$
3. $|xy| \leq$ p

If we make x $=$ a and y $= b^p c^p$ and z $= \varepsilon$ then s $\in$ F.

### Solution c

Solution a gives gives strings $\notin$ F while solution b gives strings $\in$ F. This proves that languages that are pumped do not necisarily have to be regular even though all regular languages can be pumped.