CSci 435: Formal Languages and Automata

Name: Cody Nelson

**Home Assignment 1: 35 + 10 (optional) points**

Q1. [5] How many substrings *aab* are in *wwRw*, where w = *aabbab* ?

Hint: Generate *wwRw*, then count *aab*. aabbabbabbaaaabbab

2

Q2. [10] Prove that |*un*| = *n*⋅|*u*| for all strings *u* and all *n* by ***Induction*** on ***n***.

Base Case: n=1, |u1|=1|u|, assuming u0 would be an empty string = 0

Inductive Step: Let |uk|=k|u|

Then |uk+1|=|uk|+|u|=k|u| + |u| (inductive hypothesis)

=(k+1)|u|

This proves that |uk+1|=(k+1)|u|

Q3. [10] The reverse of a string can be defined by the *recursive rules*

*a*R = *a*;

(*wa*)R = *aw*R; for all *a* ∈ Σ, *w* ∈ Σ\*.

Using the above definition and ***Induction*** on |*w*|=*n*, prove that (*uv*)R = *v*R*u*R for all *u, v* ∈ .

I’m going to let w = |u|, where |u| = n

Base case: n=1, (1v)R = vR1 = vR

Inductive Step: (kv)R = vRkR = vR1R = vR1 = vR

Then ((k+1)v)R = vR(k+1)R, (kv + v)R = (vk + v)R (given common exponent)

Proving that k -> k+1 works here.

Q4. [10] Let L = {*ab, aa, baa*}.

(A) Which of the following strings are in L\*?

* *abaabaaabaa,* ∈ L\* ? This is in L\* but not L4
* *aaaabaaaa,* ∈ L\* ? This is in L\* and L4
* *baaaaabaaaab* ∈ L\* ? This is neither L\* nor L4
* *baaaaabaa* ∈ L\* ? This is in L\* and L4
* Which strings are in L4?

(B) Similarly, which of them are in L4?

Q5. [10, optional ] Prove that for all languages *L1* and *L2*.

Hint: To prove A = B, You must prove both A ⊆ B and B ⊆ A.

To prove A ⊆ B, apply the definition of subset-ness of sets: ∀x ∈A → ∀x ∈B iff A ⊆ B.