Lecture #1: Welcome to CPSC 351!

Lecture Presentation

## Things To Do Before the Lecture

1. Go to the “Intro and Review” part of the course web site.
2. Skim through the “Mathematics Review” material, to make sure that everything is familiar (or easy to understand, if anything is new).
3. Complete the first part of the “Required Viewing or Reading” for Lecture #1. If you are short of time: You will probably be able to understand the videos if you view them at double speed.
4. Complete the second part of the “Required Viewing or Reading” for Lecture #1, by reading either the (slightly longer) “Alphabets, Strings and Languages” document or the “Key Concepts” document found immediately after it on the course web site. The longer document includes a few examples that the “Key Concepts” document does not have, but the “Key Concepts” document includes all of the definitions and notation that will be needed, later on.
5. ***Print*** and read through the rest of this document and — if you have time — try to solve the problems! These should help you to make sure that you can use proof techniques, that you learned about in CPSC 251 or MATH 271, to solve some of the problems that will be considered in this course.
6. List any ***questions*** about this course, of the problems to be considered in this lecture, that you might wish to ask during the presentation. There is room for some of these below.

## A Problem To Be Solved

Let $\Sigma = \{\mathtt{a}, \mathtt{b}\}$. Suppose that $L_0, L_1, L_2 \subseteq \Sigma^\star$, and that these languages satisfy the following properties.

(a) $\lambda \in L_0$, $\lambda \notin L_1$, and $\lambda \notin L_2$.

(b) For every string $\omega \in \Sigma^\star$ such that $\omega \in L_0$, $\omega \cdot \mathtt{a} \in L_1$, $\omega \cdot \mathtt{a} \notin L_0$, and $\omega \cdot \mathtt{a} \notin L_2$.

(c) For every string $\omega \in \Sigma^\star$ such that $\omega \in L_0$, $\omega \cdot \mathtt{b} \in L_0$, $\omega \cdot \mathtt{b} \notin L_1$, and $\omega \cdot \mathtt{b} \notin L_2$.

(d) For every string $\omega \in \Sigma^\star$ such that $\omega \in L_1$, $\omega \cdot \mathtt{a} \in L_2$, $\omega \cdot \mathtt{a} \notin L_0$, and $\omega \cdot \mathtt{a} \notin L_1$.

(e) For every string $\omega \in \Sigma^\star$ such that $\omega \in L_1$, $\omega \cdot \mathtt{b} \in L_1$, $\omega \cdot \mathtt{b} \notin L_0$, and $\omega \cdot \mathtt{b} \notin L_2$.

(f) For every string $\omega \in \Sigma^\star$ such that $\omega \in L_2$, $\omega \cdot \mathtt{a} \in L_0$, $\omega \cdot \mathtt{a} \notin L_1$, and $\omega \cdot \mathtt{a} \notin L_2$.

(g) For every string $\omega \in \Sigma^\star$ such that $\omega \in L_2$, $\omega \cdot \mathtt{b} \in L_2$, $\omega \cdot \mathtt{b} \notin L_0$, and $\omega \cdot \mathtt{b} \notin L_1$.

### One Claim To Try To Prove

**Claim 1.** *Let $\Sigma$ and $L_0$ be as given above. Then, for every string $\omega \in \Sigma^\star$, $\omega \in L_0$ if and only if the number of copies of "$\mathtt{a}$" in $\omega$ is divisible by $3$.*

**Choosing a Proof Technique:**

**How a Proof Would Start:**

## What Happens After This — and Why Can the Proof Not Be Completed?

## Another Proof To Try To Prove

**Claim 2.** *Let $\Sigma$, $L_0$, $L_1$ and $L_2$ be as given above. Then the following properties are satisfied.*

*(a) For every string $\omega \in \Sigma^\star$, $\omega \in L_0$ if and only if the number of copies of "*`a`*" in $\omega$ is divisible by $3$.* In other words, *$\omega \in L_0$ if and only if the number of copies of "*`a`*" in $\omega$ is congruent to $0$ modulo $3$.*

*(b) For every string $\omega \in \Sigma^\star$, $\omega \in L_1$ if and only if the number of copies of "*`a`*" in $\omega$ is congruent to $1$ modulo $3$.*

*(c) For every string $\omega \in \Sigma^\star$, $\omega \in L_2$ if and only if the number of copies of "*`a`*" in $\omega$ is congruent to $2$ modulo $3$.*

**Choosing a Proof Technique:**

**How a Proof Would Start:**

### What Happens After This?

**OK. The Proof Can Be Completed. What Do We Do Next?**

## How Do I Assess My Work?

## How Can I Keep This Organized?