

# Lecture #9: Nonregular Languages, Part Two

## What Will Happen During the Lecture

### Remember... You Had Homework!

Students were asked to work through the following set of lecture notes before this lecture.

- Lecture Notes — “Nonregular Languages, Part Two”.

As always, you may attend the lecture presentation if you have not worked through this material ahead of time — but it will not be repeated for you, and you might get a little bit lost, during the presentation, if you haven’t worked through this.

### Problems To Be Solved

1. Let  $\Sigma = \{a, b\}$ . Using one or more the **closure properties** for regular languages, that have now been discussed in class, we will show that the language

$$L = \{\omega \in \Sigma^* \mid \text{the number of a's in } \omega \text{ is equal to the number of b's in } \omega\} \subseteq \Sigma^*$$

is not a regular language.

2. In order to have *another* closure property that can be used to prove that languages are not regular, we will prove the following: For every alphabet  $\Sigma$  and for languages  $L_1, L_2 \subseteq \Sigma^*$ , if  $L_1$  is a regular language and  $L_2$  is a regular language then their **intersection**,  $L_1 \cap L_2$ , is also a regular language.
3. If there is time then the above closure property will be used to provide a *different* proof that the language  $L$ , introduced in Problem #1, is not a regular language.

### If You Want To Get Started . . .

If you have time then you should try to solve the above problem ahead of time — or, if you do not feel ready to do that, list the steps that you should take (and the things you need to discover) in order to do this.

An outline for notes, to be used during the lecture presentation, is also available. If you time then you might also wish to fill in parts of this outline in order to be better prepared for the presentation.