Lecture 7

Introduction to Formal Languages

CS 241: Foundations of Sequential Programs
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Motivation

- precision of specification and recognition
- importance of this: every assignment from this point forward
- benefits of theory:
Terminology

▶ rooted in set theory
▶ alphabet: a finite set of symbols

▶ word (aka string, sentence): finite sequence of symbols from the alphabet
Terminology (continued)

- language: set of words

- $|W|$: the size of $W$ (where $W$ is a word or language)
Uses of Formal Languages: Specification
Uses of Formal Languages: Recognition
WLP

Let’s try to formally specify WLP.

▶ alphabet:

▶ word:

▶ language:
Language Classes

- a set of languages may share common characteristics
- Chomsky Hierarchy
Uses of Formal Languages: Organization of Compilation

- lexical analysis
- syntactic analysis
- context-sensitive analysis (semantic) analysis
- synthesis (code generation)
Which language level?

Let $\Sigma =$\{ASCII characters\} - \{CR\}. 

- $L_1 =$\{$0, 1, 2, \ldots, 31$ \}

- $L_2 =$ valid labels in MIPS

- $L_3 =$ valid load word (lw) offsets

- $L_4 =$ valid line of AL for A3P3

- $L_5 =$ valid line of AL for A3P4
Regular Languages

- Defining regular languages: two approaches

- We will see that these are equivalent
Basic building blocks

1. finite languages
2. union
3. concatenation
4. repetition
Union

- Definition:

- Examples:
Concatenation

- Definition:

- Examples:
Repetition

- Definition:

- Alternate Definition:

- Examples: