

# CMSC 330: Organization of Programming Languages

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## Context-Free Grammars

### Reminders / Announcements

- Project 2 was posted on Sep. 24
- Class participation is part of your grade

## Motivation

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- **Programs are just strings of text**
  - But they're strings that have a certain structure
    - A C program is a list of declarations and definitions
    - A function definition contains parameters and a body
    - A function body is a sequence of statements
    - A statement is either an expression, an if, a goto, etc.
    - An expression may be assignment, addition, subtraction, etc
- **We want to solve two problems**
  - We want to describe programming languages precisely
  - We need to describe more than the regular languages
    - Recall that regular expressions , DFAs, and NFAs are limited in their expressiveness

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## Program structure

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### Syntax

- What a program looks like
- BNF (context free grammars) - a useful notation for describing syntax.

### Semantics

- Execution behavior

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## Context-Free Grammars (CFGs)

- A way of generating sets of strings or languages
- They subsume regular expressions (and DFAs and NFAs)
  - There is a CFG that generates any regular language
  - (But regular expressions are a better notation for languages which are regular.)
- They can be used to describe programming languages
  - They (mostly) describe the parsing process

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## Simple Example

$S \rightarrow 0|1|0S|1S|\epsilon$

- This is the same as the regular expression  $(0|1)^*$
- But CFGs can do a lot more!

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