CS4022D Principles of Programming Languages
Syntax

Saleena N
NIT Calicut

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Programming Language Definition

- Syntax
- Semantics
- Type System

Syntax

- Concerned with the *structure* of the program
- Formally specified
- Context Free Grammar / BNF

Syntax

$S \rightarrow a = E$
$E \rightarrow E + E \mid a$

- What is the language described?
- Language?

Language

A set of strings over an alphabet

- $L_1 = \{a, \ ab, \ bb, \ aa\}$
- $L_2 = \{aaa, \ bbb\}$
- $L_3 = \{a, \ b, \ aa, \ bb\}$

Grammar

$$G = (V,\ T,\ P,\ S)$$

- V: Set of Variables (Non Terminals)
- T: Set of Terminals
- P: Set of Productions (Grammar rules)
- S: Start Symbol

Syntax

$S \rightarrow a = E$
$E \rightarrow E + E \mid a$

- $G = (V, T, P, S)$?
- Strings in the language ?

Syntax

$S \rightarrow a = E$
$E \rightarrow E + E \mid a$

- Strings in the language: strings derivable from the start symbol

Syntax

$S \rightarrow a = E$
$E \rightarrow E + E \mid a$

- Strings in the language: $a = a$, $a = a + a$, $a = a + a + a$
- Show that $a = a + a \in L(G)$

Syntax

$S \rightarrow a = E$
$E \rightarrow E + E \mid a$

- Derivations
- $S \Rightarrow a = E \Rightarrow a = E + E \Rightarrow a = a + E \Rightarrow a = a + a$

Syntax Tree

$S \rightarrow a = E$
$E \rightarrow E + E \mid a$

- Draw the Derivation Tree / Parse tree for $a = a + a$
- Derivation Tree / Parse tree / Concrete Syntax Tree
- Abstract Syntax Tree (AST) ?
- Number of nodes in Parse Tree, AST?

Syntax: BNF like notation

$$\begin{aligned} S &::= a = e \\ e &:= e + e \mid a \end{aligned}$$

Language of Binary

t::=		*terms*
	0	*constant zero*
	1	*constant one*
	and t t	
	or t t	
	not t	

Language of Binary: Terms / Programs

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and 1 0
and (not 1) 0
or (and 0 1) (not 0)
and (or 0 1) (not or (1 0)
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