

Concepts of Programming Languages, CSCI 305, Fall 2021
Attribute Grammars, Section 4.3, pages 187-194, Nov. 15

Attribute grammars – used to add meaning to a grammar.
 Attach attributes to the elements of a production.

Example which associates values (val) with expressions:

Grammar	Attribute grammar
$E \rightarrow E + T$	$E \rightarrow E + T$ $E_1.val = E_2.val + T.val$
$E \rightarrow E - T$	$E \rightarrow E - T$ $E_1.val = E_2.val - T.val$
$E \rightarrow T$	$E \rightarrow T$ $E.val = T.val$
$T \rightarrow T * F$	$T \rightarrow T * F$ $T_1.val = T_2.val * F.val$
$T \rightarrow T / F$	$T \rightarrow T / F$ $T_1.val = T_2.val / F.val$
$T \rightarrow F$	$T \rightarrow F$ $T.val = F.val$
$F \rightarrow - F$	$F \rightarrow - F$ $F_1.val = - F_2.val$
$F \rightarrow (E)$	$F \rightarrow (E)$ $F.val = E.val$
$F \rightarrow \text{Const}$	$F \rightarrow \text{const}$ $F.val = \text{const}$

Attribute grammar variables can be characterized as:

- Intrinsic – look-up value
- Synthesized – Variables on the left side of a production get attribute values calculated from values on the right side of the production (children). In other words, attribute values come from values lower in the parse tree.
- Inherited – Variables on the right side of a production get attribute values from items on the left side of the production (parents) or items to the left of the variable. In other words, values come from parents or siblings on the right in the parse tree.

An attribute grammar is well-defined if its rules determine a unique set of values for the attributes of every parse tree.

An attribute grammar is noncircular if it never leads to a parse tree in which there are cycles in the attribute flow graph.