Compiler Design

CHAPTER 5

SYNTAX DIRECTED TRANSLATION

Syntax Directed Definitions

- Syntax Directed Definitions are a generalization of context-free grammars with attributes and rules in which:

1. Grammar symbols have an associated set of Attributes;

2. Productions are associated with Semantic Rules for computing the values of attributes.

- Such formalism generates Annotated Parse-Trees where each node of the tree is a record with a field for each attribute (e.g., X.a indicates the attribute a of the grammar symbol X).

Attributes may be of any kind: numbers, types, table references or strings.

Syntax Directed Definitions contd..

Evaluation of Semantic Rules may:

– Generate Code;

– Insert information into the Symbol Table;

– Perform Semantic Check;

– Issue error messages;

• There are two notations for attaching semantic rules:

1. Syntax Directed Definitions. High-level specification hiding many implementation details (also called Attribute Grammars).

2. Translation Schemes. More implementation oriented: Indicate the order in which semantic rules are to be evaluated.

Syntax –directed definition(SDD)of a simple desk calculator

Production	Semantic Rules
1) L → E n	L.val = E.val
2) E → E1 + T	E.val = E1.val + T.val
3) E → T	E.val = T.val
4) T → T1 * F	T.val = T1.val * F.val
5) T → F	T.val = F.val
6) F → (E)	F.val = E.val
7) F → digit	F.val = digit.lexval

Write S-Attributed Definition for the grammar given

Conversion of Binary to Decimal

G:

D→D B | B

B→0 | 1

S-Attributed definitions

- An SDD is S-attributed if every attribute is synthesized.
- We can have a post-order traversal of parse-tree to evaluate attributes in

  S-attributed definitions

```
postorder(N) {
for (each child C of N, from the left) postorder(C);
evaluate the attributes associated with node N;
}
```

S-Attributed definitions can be implemented during bottom-up parsing without the need to explicitly create parse trees.

Annotated Parse Tree

A parse tree, showing the values of its attributes is called Annotated Parse Tree(APT).

Construct an APT for 3*5+4n

Syntax Directed Definitions contd..

- The value of an attribute of a grammar symbol at a given parse-tree node is defined by a semantic rule associated with the production used at that node.

- • We distinguish between two kinds of attributes:
- 1. Synthesized Attributes. They are computed from the values of the attributes of the children nodes.
  - A synthesized attribute at node N is defined in terms of attribute values at the children of N and at N itself.
- 2. Inherited Attributes. They are computed from the values of the attributes of both the siblings and the parent nodes.
  - An inherited attribute at node N is defined in terms of attribute values at N's parent, N's siblings and at N itself.