

CSC 340: Programming Language and Compilation
Exercises: Syntax Directed Definition

Q1. For the SDD of fig 1, give annotated parse trees for the following expressions:

- a- $(3+4) * (5+6)n$
- b- $1*2*3*(4+5)n$
- c- $(9+8*(7+6)+5) *4n$

Production	Semantic Rules
$L \rightarrow En$	$L.val = E.val$
$E \rightarrow E_1 + T$	$E.val = E_1.val + T.val$
$E \rightarrow T$	$E.val = T.val$
$T \rightarrow T_1 * F$	$T.val = T_1.val * F.val$
$T \rightarrow F$	$T.val = F.val$
$F \rightarrow (E)$	$F.val = E.val$
$F \rightarrow digit$	$F.val = digit.lexval$

Fig 1 Syntax-directed definition of the simple desk calculator [1]

Q2. For the SDD of fig 2 , give annotated parse trees and the Dependency Graphs for the following expressions:

- a- Int a,b,c,d
- b- Float w,x,y

Productions	Semantic Rules
(1) $D \rightarrow TL$	$L.inh = T.type$
(2) $T \rightarrow int$	$T.type = integer$
(3) $T \rightarrow float$	$T.type = float$
(4) $L \rightarrow L_1, id$	$L_1.inh = L.inh$ $addType(id.entry, L.inh)$
(5) $L \rightarrow id$	$addType(id.entry, L.inh)$

Fig 2: Syntax directed Definition for simple type declaration [1]

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Q3. Suppose we have a production $A \rightarrow BCD$. Each of the four non-terminals A, B, C and D have two attributes 's' is the synthesized attribute, and 'i' is an inherited attribute. For each of the set of rules below, tell whether

- (i) the rules are consistent with an S-attributed definition
 - (ii) the rules are consistent with an L-attributed definition
- a) $A.s = B.i + C.s$
 - b) $A.s = B.i + C.s$ and $D.i = A.i + B.s$
 - c) $A.s = B.s + D.s$
 - d) $A.s = D.i$, $B.i = A.s + C.s$, $C.i = B.s$ and $D.i = B.i + C.i$

Q4. Below is a grammar for expressions involving operator + and integer or floating-point operands. Floating-point numbers are distinguished by having a decimal point.

$$E \rightarrow E + T \mid T$$
$$T \rightarrow \text{num} . \text{num} \mid \text{num}$$

Give an SDD to determine the types of each term T and expression E .

[1] Book: "Compilers Principles, techniques, & tools", Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman