

Homework Answer

Chapter 6

6.7 Consider the following grammar for simple Pascal-style declarations:

$\text{decl} \rightarrow \text{var-list: type}$

$\text{vsr-list} \rightarrow \text{var-list, id}$

$\text{type} \rightarrow \text{integer}$

$\text{type} \rightarrow \text{real}$

Write the attribute grammar for this grammar.

Solution:

$\text{decl} \rightarrow \text{var-list: type}$

$\text{var-list.dtype} = \text{type.dtype}$

$\text{vsr-list}_1 \rightarrow \text{var-list}_2, \text{id}$

$\text{var-list}_2.dtype = \text{var-list}_1.dtype$

$\text{id.dtype} = \text{var-list}_1.dtype$

$\text{type} \rightarrow \text{integer}$

$\text{type.dtype} = \text{int}$

$\text{type} \rightarrow \text{real}$

$\text{type.dtype} = \text{float}$

6.8 Consider the grammar of 6.7. Rewrite the grammar so that the type of a variable can be purely synthesized attribute, and give a new attribute grammar for the type has this property.

Solution:

$\text{decl} \rightarrow \text{id var-list}$	$\text{id.dtype} = \text{var-list.dtype}$
$\text{var-list}_1 \rightarrow , \text{id var-list}_2$	$\text{var-list}_1.dtype = \text{var-list}_2.dtype$
	$\text{id.dtype} = \text{var-list}_2.dtype$
$\text{var-list} \rightarrow : \text{type}$	$\text{var-list.dtype} = \text{type.dtype}$
$\text{type} \rightarrow \text{integer}$	$\text{type.dtype} = \text{int}$
$\text{type} \rightarrow \text{real}$	$\text{type.dtype} = \text{float}$

6.13 Consider the following attribute grammar:

Grammar Rule	Semantic Rule
$S \rightarrow A B C$	$B.u = S.u$ $C.u = A.v$ $A.u = B.v + c.v$ $S.v = A.v$
$A \rightarrow a$	$A.v = 2 * A.u$
$B \rightarrow b$	$B.v = B.u$
$C \rightarrow c$	$C.v = 1$

- (a) Draw the parse tree for string `abc`, and draw the dependency graph for the associated attributes. Describe a correct order for the evaluation of the attributes.
- (b) Suppose that $S.u$ is assigned the value of 3 before attribute evaluation begins. What is the value of $S.v$ when the evaluation has finished?

(c) Suppose the attribute equations are modified as follows:

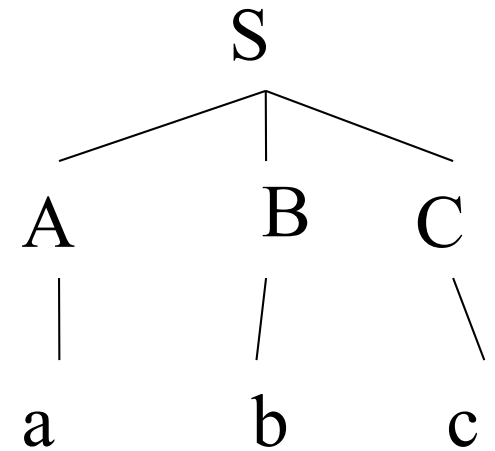
Grammar Rule	Semantic Rule
$S \rightarrow A B C$	$B.u = S.u$ $A.u = B.v + c.v$ $S.v = A.v$
$A \rightarrow a$	$A.v = 2 * A.u$
$B \rightarrow b$	$B.v = B.u$
$C \rightarrow c$	$C.v = C.u - 2$

What value does $S.v$ have after attribute evaluation, if $S.u=3$ before evaluation begins?

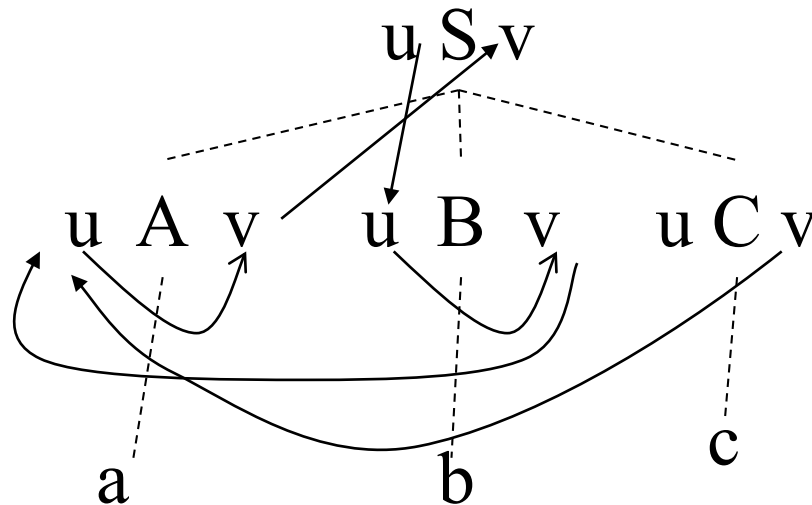
6.13

Solution:

(a) The parse tree for the string abc is:



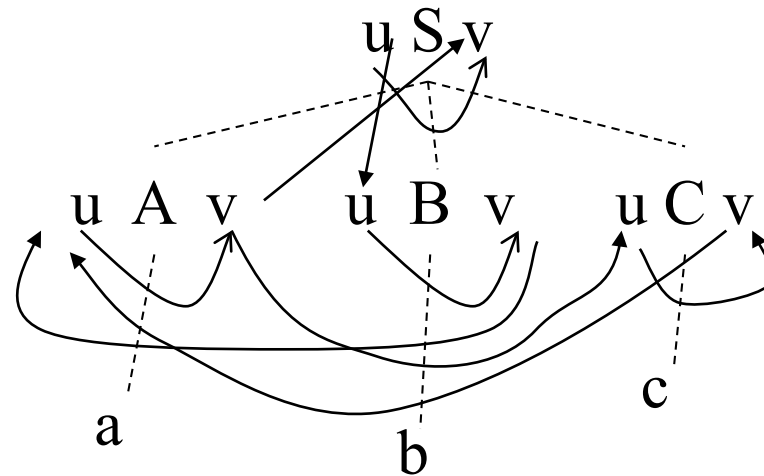
The dependency graph is:



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(b) $S.v = A.v = 2 * A.u = 2 * (B.v + C.v) = 2 * (B.u + C.v) = 2 * (S.u + C.v) = 8$

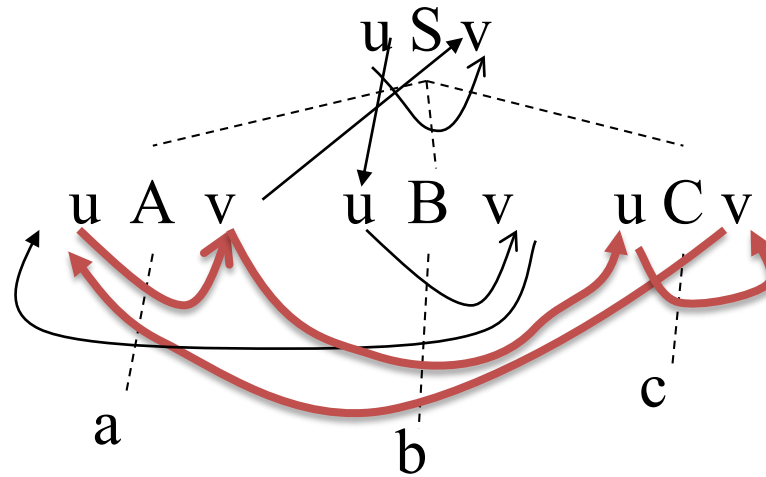
(c) The dependency graph becomes as follows:



$$C.v = C.u - 2 = A.v - 2 = 2 * A.u - 2 = 2(B.v + C.v) - 2 = 2(B.u + C.v) - 2 = 2(S.u + C.v) - 2$$

$$C.v = 2 - 2 * S.u = -4$$

$$S.v = 2(S.u + C.v) = -2$$



The dependency of $C.v$, $A.u$, $A.v$, $C.u$ form a cycle, so the value $S.v$ cannot be evaluated generally.