

Exercise Sheet 8

Assignment 8.1 Strongly Acyclic Attribute Grammars

Consider Attribute Grammar G :

$$\begin{array}{lcl}
 S' & \rightarrow & A^0 \\
 A & \rightarrow & s B^0 \\
 & | & t B^1 \\
 B & \rightarrow & u^0 \\
 & | & v^1
 \end{array}
 \left|
 \begin{array}{l}
 z[0] := z[1] \quad c[1] := 0 \\
 a[2] := y[2] \quad b[2] := c[0] \quad z[0] := x[2] \\
 a[2] := c[0] \quad b[2] := x[2] \quad z[0] := y[2] \\
 x[0] := a[0] \quad y[0] := b[0] \\
 y[0] := x[0] \quad x[0] := 0
 \end{array}
 \right.$$

1. Is G strongly acyclic?
2. Let G' be G with $(B, 0)$ removed; is G' strongly acyclic?

Suggested Solution 8.1

1. G is not strongly acyclic.

N	$\mathcal{R}(N)$
B	$(a, x), (b, y), (x, y)$
A	(c, z)
S'	

$$\begin{aligned}
 & D(A \rightarrow s B) \cup \{(a[2], x[2]), (b[2], y[2]), (x[2], y[2])\} = \\
 & \{(y[2], a[2]), (c[0], b[2]), (x[2], z[0])\} \cup \{(a[2], x[2]), (b[2], y[2]), (x[2], y[2])\}
 \end{aligned}$$

\Rightarrow there is a cycle, covering $y[2], a[2], x[2]$

- 2.

N	$\mathcal{R}(N)$
B	(x, y)
A	
S'	

Yes, it is

Assignment 8.2 L-attributed Grammars – Binary numbers

Consider the following grammar for binary numbers:

$$\begin{aligned} S &\rightarrow L.L|L \\ L &\rightarrow LB|B \\ B &\rightarrow 0|1 \end{aligned}$$

We want to obtain an l-attributed grammar that compute the decimal value of the represented binary number. Add attributes and semantic rules to the grammar such that the decimal value of the derived binary number is computed in an attribute v at non-terminal S . For example, the word 10.11 should be evaluate to 2.75. The obtained attribute system should be l-attributed! You may use an inherited attribute that tells which side of the point a bit is on.

Suggested Solution 8.2

$$\begin{array}{ll} S \rightarrow L.L & \begin{array}{l} v[0] = v[1] + v[3] \\ s[1] = 0 \\ p[3] = -1 \end{array} \\ S \rightarrow L & \begin{array}{l} v[0] = v[1] \\ s[1] = 0 \end{array} \\ L \rightarrow LB & \begin{array}{l} v[0] = v[1] + v[2] \\ s[1] = s[0] + 1 \\ s[2] = s[0] \\ p[1] = p[0] \end{array} \quad \begin{array}{l} \text{if } s[0] \text{ is defined} \\ \text{if } s[0] \text{ is defined} \\ \text{if } p[0] \text{ is defined} \end{array} \\ L \rightarrow B & \begin{array}{l} p[2] = e[1] - 1 \\ v[0] = v[1] \\ s[1] = s[0] \\ p[1] = p[0] \\ e[0] = e[1] - 1 \\ p[2] = e[0] \end{array} \quad \begin{array}{l} \text{if } e[1] \text{ is defined} \\ \\ \text{if } s[0] \text{ is defined} \\ \text{if } p[0] \text{ is defined} \\ \text{if } e[1] \text{ is defined} \\ \text{if } e[0] \text{ is defined} \end{array} \\ B \rightarrow 0 & v[0] = 0 \\ B \rightarrow 1 & v[0] = \begin{cases} 2^{s[0]} & \text{if } s[0] \text{ is defined} \\ 2^{p[0]} & \text{if } p[0] \text{ is defined} \end{cases} \end{array}$$