Chapter 0

Exercises

Course “Compiler Construction”

Martin Steffen

Spring 2024

Section

Exercises 05 (ST)

1. Postfix string as attribute
2. Simple Pascal-style type declarations
3. Dependency graphs and evaluation
4. Attribute grammar for classes

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4. Attribute grammar for classes

5.1: Original grammar

$$
\begin{array}{rcl}
exp & \rightarrow & exp + term \mid exp - term \mid term \\
term & \rightarrow & term * factor \mid factor \\
factor & \rightarrow & (exp) \mid \mathbf{number}
\end{array}
$$

5.1: Original AG for evaluation

	productions/grammar rules			semantic rules
1	exp_1	$\rightarrow$	$exp_2 + term$	exp_1 .val $= exp_2$ .val $+ term$ .val
2	exp_1	$\rightarrow$	$exp_2 - term$	exp_1 .val $= exp_2$ .val $- term$ .val
3	exp	$\rightarrow$	$term$	exp .val $= term$ .val
4	$term_1$	$\rightarrow$	$term_2 * factor$	$term_1$ .val $= term_2$ .val $* factor$ .val
5	$term$	$\rightarrow$	$factor$	$term$ .val $= factor$ .val
6	$factor$	$\rightarrow$	(exp)	$factor$ .val $= exp$ .val
7	$factor$	$\rightarrow$	**number**	$factor$ .val $=$ **number**.val

5.2: (Type declarations): Underlying grammar

$$
\begin{aligned}
\textit{decl} &\rightarrow \textit{var-list} : \textit{type} \\
\textit{var-list} &\rightarrow \textit{var-list} \ \textbf{,} \ \textbf{id} \mid \textbf{id} \\
\textit{type} &\rightarrow \textbf{integer} \mid \textbf{real}
\end{aligned}
$$

5.3 (evaluation): Artificial AG

productions/grammar rules			semantic rules
S	$\rightarrow$	ABC	$B.\mathrm{u} = S.\mathrm{u}$
			$A.\mathrm{u} = B.\mathrm{v} + C.\mathrm{v}$
			$S.\mathrm{v} = A.\mathrm{v}$
A	$\rightarrow$	a	$A.\mathrm{v} = 2 * A.\mathrm{u}$
B	$\rightarrow$	b	$B.\mathrm{v} = B.\mathrm{u}$
C	$\rightarrow$	c	$C.\mathrm{v} = 1$

5.3: Changed AG

production/grammar rule			semantic rules
S	$\rightarrow$	ABC	$B.\mathrm{u} = S.\mathrm{u}$
			$C.\mathrm{u} = A.\mathrm{v}$
			$A.\mathrm{u} = B.\mathrm{v} + C.\mathrm{v}$
			$S.\mathrm{v} = A.\mathrm{v}$
A	$\rightarrow$	a	$A.\mathrm{v} = 2 * A.\mathrm{u}$
B	$\rightarrow$	b	$B.\mathrm{v} = B.\mathrm{u}$
C	$\rightarrow$	c	$C.\mathrm{v} = C.\mathrm{u} - 2$

5.4: AG for classes

Constructors

productions/grammar rules			semantic rules
$class$	$\rightarrow$	**class name** $superclass$ **{** $decls$ **}**	
$decls$	$\rightarrow$	$decls$ **;** $decl$	
$decls$	$\rightarrow$	$decl$	
$decl$	$\rightarrow$	$variable\text{-}decl$	not to be filled out
$decl$	$\rightarrow$	$method\text{-}decl$	
$method\text{-}decl$	$\rightarrow$	$type$ **name** **(** $params$ **)** $body$	
$type$	$\rightarrow$	**int**	
$type$	$\rightarrow$	**bool**	
$type$	$\rightarrow$	**void**	
$(superclass$	$\rightarrow$	**name**$)$	filled by lexer