Compiler Construction/Fall 2014/Homework 5

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Assigned Thursday 10/2/2014, due Thursday 10/9/2014 at 8am

Reading Assignments

- Lecture 5 on 10/2/2014 (this homework): Name Analysis. Dragon book 1.6, 2.7 (15p).
- Lecture 6 on 10/9/2014: Type Analysis. Dragon book 6.3, 6.5 (20p).

Homework Assignments

The following assignments should be submitted for a maximum of 25 points.

1 Name Analysis

In the following exercises we will work with two different grammars for the same language, and will ask that you consider the differences between the two corresponding forms of ASTs.

The language is designed to just permit simple schematic patterns of *definition* and *use* of scoped variables – "def-use" – like this small example program illustrates:

```
1 {
2   def x; def y;
3   use y; { def x; use x; }
4   use x;
5 }
```

The first grammar is called A and has productions prefixed with A:

$$\begin{aligned} \mathit{AProg} &\to \mathit{ABlock} \\ \mathit{ABlock} &\to \texttt{\{}\ \mathit{AStats}\ \texttt{\}} \\ \mathit{AStats} &\to \mathit{AStat}\ \mathit{AStats} \mid \epsilon \\ \mathit{AStat} &\to \texttt{def}\ \textbf{id;} \mid \texttt{use}\ \textbf{id;} \mid \mathit{ABlock} \end{aligned}$$

The second grammar, similarly, is B:

$$\begin{aligned} \mathit{BProg} &\to \mathit{BBlock} \\ \mathit{BBlock} &\to \texttt{\{}\ \mathit{BStat}\ \texttt{\}} \\ \mathit{BStat} &\to \texttt{def}\ \textbf{id;}\ \mathit{BStat} \mid \texttt{use}\ \textbf{id;}\ \mathit{BStat} \mid \mathit{BBlock}\ \mathit{BStat} \mid \epsilon \end{aligned}$$

Question 1.1 (Grammar comparison, 5 points)**.** Consider the program given above. Draw the syntax tree that is obtained by parsing with each of A and B, and annotate each node in both trees with the *list of variables that are in scope*.

Question 1.2 (SDD for A, 10 points)**.** Write an SDD (Syntax-Directed Definition) that for every statement node in A-parsed parse trees synthesizes an attribute ok that is $true$ when all `use` statements only use a variable that *in-scope* for that node. (Note: You may use other attributes, if you wish, just remember to *document all attributes that you use*. You may also use any auxiliary operators that you need, like set operators or $\|$ for concatenation, for example.)

Question 1.3 (SDD for B, 10 points)**.** Same exercise as Question 1.2 but for parse trees generated by the B grammar. In addition, comment on what the differences are between the two.