Solutions to 5th Coursework
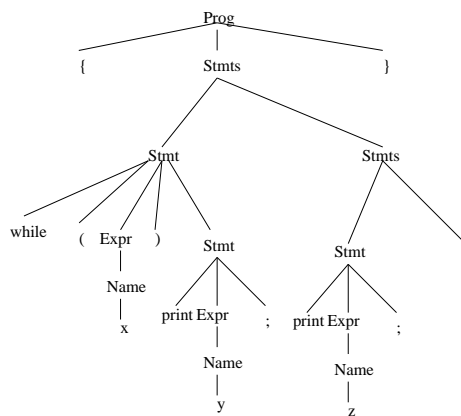
8/8/2004

1. Decide which of the following are correct P programs.

    (a) `{ print x ; { print y ; } }`

      is correct.

    (b) `{ if( x ) ; ; }`

      is correct.

    (c) `{ x = x + 1 ; print x ; }`

      is not correct - the brackets arround `x + 1` are missing.

    (d) `{ print y }`

      is not correct — the ; after `print` is missing.

    (e) `{ while ( z ) { x = ( x + 1 ) ; } print y ; }`

      is correct.

    (f) `{ { { } } }`

      is correct.

    (g) `{ print ( 0 ) ; }`

      is not correct — correct would be `{ print 0 ; }`

    (h) `{ if ( x = 0 ) print x ; }`

      is not correct — `x = 0` is not an expression.

    (i) `print x ;`

      is not correct — every program starts with { and ends with }.

      `{ x = ( 0 ) ; }`

      is not correct — `( 0 )` is not an expression.

    (j) `{ while ( x ) { } while ( y ) { } }`

      is correct.

2. (a)

$$Prog \Rightarrow \{\,Stmts\,\}$$
$$\Rightarrow \{\,Stmt\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ Expr\ )\ Stmt\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ Name\ )\ Stmt\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ Stmt\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ \texttt{print}\ Expr\ ;\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ \texttt{print}\ Name\ ;\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ \texttt{print}\ \texttt{y}\ ;\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ \texttt{print}\ \texttt{y}\ ;\ Stmt\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ \texttt{print}\ \texttt{y}\ ;\ \texttt{print}\ Name\ ;\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ \texttt{print}\ \texttt{y}\ ;\ \texttt{print}\ \texttt{z}\ ;\ Stmts\,\}$$
$$\Rightarrow \{\texttt{while}\ (\ \texttt{x}\ )\ \texttt{print}\ \texttt{y}\ ;\ \texttt{print}\ \texttt{z}\ ;\ \}$$

(b)

$$
\begin{aligned}
Prog &\Rightarrow \{\, Stmts\ \} \\
&\Rightarrow \{\, Stmt\ Stmts\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ Expr\ )\ Stmt\ Stmts\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ Name\ )\ Stmt\ Stmts\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ Stmt\ Stmts\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ Stmt\} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ Prog\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ Stmts\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ Stmt\ Stmts\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ Expr\ ;\ Stmts\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ Name\ ;\ Stmts\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ \texttt{y}\ ;\ Stmts\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ \texttt{y}\ ;\ Stmt\ Stmts\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ \texttt{y}\ ;\ Stmt\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ \texttt{y}\ ;\ \texttt{print}\ Expr\ ;\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ \texttt{y}\ ;\ \texttt{print}\ Name\ ;\ \}\ \} \\
&\Rightarrow \{\, \texttt{while}\ (\ \texttt{x}\ )\ \{\ \texttt{print}\ \texttt{y}\ ;\ \texttt{print}\ \texttt{z}\ ;\ \}\ \}
\end{aligned}
$$