School for Computer Science and Information Technology
Machines and their languages (G51MAL) Spring 2004
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Solutions to 7th Coursework

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1. Construct First and Follow-sets for all non-terminal symbols of G (using the augmented grammar $G^{\$}$).

$\text{First}(\mathit{Prog}) = \{\{\}$
$\text{First}(\mathit{Stmts}) = \text{First}(\mathit{Stmt}) = \{\texttt{x}, \texttt{y}, \texttt{z}, \texttt{if}, \texttt{while}, \texttt{print}, \texttt{;}, \{\}$
$\text{First}(\mathit{Expr}) = \{\texttt{x}, \texttt{y}, \texttt{z}, \texttt{0}, \texttt{1}, \texttt{(}\}$
$\text{First}(\mathit{Name}) = \{\texttt{x}, \texttt{y}, \texttt{z}\}$
$\text{First}(\mathit{Op}) = \{\texttt{+}, \texttt{*}, \texttt{-}, \texttt{div}\}$
$\text{First}(\mathit{Num}) = \{\texttt{0}, \texttt{1}\}$

$\text{Follow}(\mathit{Prog}) = \{\$, \}, \texttt{x}, \texttt{y}, \texttt{z}, \texttt{if}, \texttt{while}, \texttt{print}, \texttt{;}, \{\}$
$\text{Follow}(\mathit{Stmts}) = \{\}\}$
$\text{Follow}(\mathit{Stmt})) = \{\}, \texttt{x}, \texttt{y}, \texttt{z}, \texttt{if}, \texttt{while}, \texttt{print}, \texttt{;}, \{\}$
$\text{Follow}(\mathit{Expr})) = \{\texttt{;}, \texttt{)}, \texttt{+}, \texttt{*}, \texttt{-}, \texttt{div}\}$
$\text{Follow}(\mathit{Name})) = \{\texttt{;}, \texttt{)}, \texttt{+}, \texttt{*}, \texttt{-}, \texttt{div}, \texttt{=}\}$
$\text{Follow}(\mathit{Op})) = \{\texttt{x}, \texttt{y}, \texttt{z}, \texttt{0}, \texttt{1}, \texttt{(}\}$
$\text{Follow}(\mathit{Num})) = \{\texttt{;}, \texttt{)}, \texttt{+}, \texttt{*}, \texttt{-}, \texttt{div}\}$

2.

$\text{Lookahead}(\textit{Prog} \to \{\textit{Stmts}\}) = \{\{\}$
$\text{Lookahead}(\textit{Stmts} \to \epsilon) = \{\}\}$
$\text{Lookahead}(\textit{Stmts} \to \textit{Stmt Stmts}) = \{\texttt{x}, \texttt{y}, \texttt{z}, \texttt{if}, \texttt{while}, \texttt{print}, \texttt{;}, \{\}$
$\text{Lookahead}(\textit{Stmt} \to \textit{Name} \texttt{ = } \textit{Expr}\texttt{;}) = \{\texttt{x}, \texttt{y}, \texttt{z}\}$
$\text{Lookahead}(\textit{Stmt} \to \texttt{if (} \textit{Expr} \texttt{)} \textit{ Stmt}) = \{\texttt{if}\}$
$\text{Lookahead}(\textit{Stmt} \to \texttt{while (} \textit{Expr} \texttt{)} \textit{ Stmt}) = \{\texttt{while}\}$
$\text{Lookahead}(\textit{Stmt} \to \texttt{print } \textit{Expr} \texttt{ ;}) = \{\texttt{print}\}$
$\text{Lookahead}(\textit{Stmt} \to \texttt{;}) = \{\texttt{;}\}$
$\text{Lookahead}(\textit{Stmt} \to \textit{Prog}) = \{\{\}$
$\text{Lookahead}(\textit{Expr} \to \textit{Name}) = \{\texttt{x}, \texttt{y}, \texttt{z}\}$
$\text{Lookahead}(\textit{Expr} \to \textit{Num}) = \{\texttt{0}, \texttt{1}\}$
$\text{Lookahead}(\textit{Expr} \to \texttt{(}\textit{Expr Op Expr}\texttt{)}) = \{\texttt{(}\}$
$\text{Lookahead}(\textit{Name} \to \texttt{x}) = \{\texttt{x}\}$
$\text{Lookahead}(\textit{Name} \to \texttt{y}) = \{\texttt{y}\}$
$\text{Lookahead}(\textit{Name} \to \texttt{z}) = \{\texttt{z}\}$
$\text{Lookahead}(\textit{Op} \to \texttt{+}) = \{\texttt{+}\}$
$\text{Lookahead}(\textit{Op} \to \texttt{*}) = \{\texttt{*}\}$
$\text{Lookahead}(\textit{Op} \to \texttt{-}) = \{\texttt{-}\}$
$\text{Lookahead}(\textit{Op} \to \texttt{div}) = \{\texttt{div}\}$
$\text{Lookahead}(\textit{Num} \to 0) = \{\texttt{0}\}$
$\text{Lookahead}(\textit{Num} \to 1) = \{\texttt{1}\}$

Yes, the grammar is LL(1).