# School for Computer Science and Information Technology

Machines and their languages (G51MAL) Spring 2004

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## 7th Coursework

16/3/2004

**Deadline:** 19/3/2004 - 15:30 (A39)

In the 5th coursework I introduced a CFG for the language P. Now we look at this grammar again to determine whether it can be implemented by an LL(1)-parser.

1. Construct First and Follow-sets for all non-terminal symbols of $G$ (using the augmented grammar $G^{\$}$).
2. Calculate the Lookahead-sets for each production to determine whether the grammar is LL(1).
3. *(optional easter homework — deadline )*
   Implement an LL(1) parser for P. This can be extended to an interpreter by allowing arbitrary names and numbers for *Name* and *Num* and by generating parse trees as implemented in `P.java`. Test your implementation on the P program `prime.p` which prints prime numbers — if your interpreter works.

   *Links*

   `P.java` `http://www.cs.nott.ac.uk/~txa/g51mal/P.java`

   `prime.p` `http://www.cs.nott.ac.uk/~txa/g51mal/prime.java`

**Reminder:** The syntax of P is given by the following CFG $G = (V, \Sigma, S, P)$:

- $V = \{Prog, Stmt, Stmts, Expr, Op, Name, Num\}$
- $\Sigma = \{\{, \}, (, ), +, *, -, \mathtt{div}, \mathtt{if}, \mathtt{while}, \mathtt{print}, =, ;, 0, 1, x, y, z\}$
- $S = Prog$

- $P$ is given by:

$$\begin{aligned}
\mathit{Prog} &\rightarrow \{\mathit{Stmts}\} \\
\mathit{Stmts} &\rightarrow \epsilon \mid \mathit{Stmt}\ \mathit{Stmts} \\
\mathit{Stmt} &\rightarrow \mathit{Name}\ \texttt{=}\ \mathit{Expr}\texttt{;} \\
&\mid \texttt{if}\ \texttt{(}\ \mathit{Expr}\ \texttt{)}\ \mathit{Stmt} \\
&\mid \texttt{while}\ \texttt{(}\ \mathit{Expr}\ \texttt{)}\ \mathit{Stmt} \\
&\mid \texttt{print}\ \mathit{Expr}\ \texttt{;} \\
&\mid \texttt{;} \\
&\mid \mathit{Prog} \\
\mathit{Expr} &\rightarrow \mathit{Name} \mid \mathit{Num} \mid \texttt{(}\mathit{Expr}\ \mathit{Op}\ \mathit{Expr}\ \texttt{)} \\
\mathit{Name} &\rightarrow \texttt{x} \mid \texttt{y} \mid \texttt{z} \\
\mathit{Op} &\rightarrow \texttt{+} \mid \texttt{*} \mid \texttt{-} \mid \texttt{div} \\
\mathit{Num} &\rightarrow 0 \mid 1
\end{aligned}$$