Formal Definition of Left

First write $U \xrightarrow{1^+} B_1 \cdots B_n$ if $U$ can produce the string $B_1 \cdots B_n$ using one or more productions.

We define, for each non-terminal $U$ in the grammar, the set $Left(U)$ to consist of those symbols that can start strings derived from $U$. I.e. If $U \xrightarrow{1^+} B_1 \cdots B_n$ then $B_1$ is in $Left(U)$.

$Left(U)$ can be derived for all non-terminals in the grammar by the following algorithm:

1. Initialise all sets $Left(U)$ to empty.
2. For each production $U \rightarrow B_1 \cdots B_n$ enter $B_1$ into $Left(U)$.
3. For each production $U \rightarrow B_1 \cdots B_n$ where $B_1$ is also a non-terminal enter all the elements of $Left(B_1)$ into $Left(U)$
4. Repeat 3. until no further change.