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Aim: Implement top down predictive parsor.

Theory: A top-down predictive parsor is a type of parser that begins parsing from the start symbol and attempts to match the input string by applying grammar production rules in a top-down manner. It builds the parse tree from the root and proceeds toward the leaves, selecting the appropriate production rule by looking ahead at the next input symbol. This method avoids backtracking by using a predictive parsing table, which guides the parser in choosing the correct rule based on the current non-terminal and lookahead token. It is designed for LL(1) grammars, where parsing decision can be made using a single lookahead symbol.

The predictive parser maintains a stack to track the symbols it needs to process. Initially, the stack contains the start symbol, and as parsing progresses, non-terminals are replaced with the right-hand side of their corresponding production rules. Terminals are matched with the input symbols. If a mismatch occurs, a syntax error is reported. This approach is efficient and easier to implement compared to parsers that use backtracking, making it suitable for simple and deterministic grammars used in programming languages.

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Requirements for LL(1) Parser.

1) **No Left Recursion**

Left recursion in a grammar occurs when a non-terminal symbol appears on the leftmost side of its own production.

LL(1) parsers are top down and cannot handle left recursion because it cause infinite loop and prevent the parser from terminating.

We can eliminate left recursion using grammar transformation

Ex $A \longrightarrow A\alpha \mid \beta$ is a left recursive grammar.

Eliminating left recursion :

$$A \longrightarrow \beta A'$$
$$A' \longrightarrow \alpha A' \mid \epsilon$$

2) **No Left Factoring**

Left factoring is a grammar transformation. It is applied when two or more productions for a non-terminal begin with the same prefix, making it unclear which rule to choose based on a single lookahead symbol.

Ex : $A \longrightarrow \alpha\beta_1 \mid \alpha\beta_2$ is left factoring

Eliminating left factoring :

$$A \longrightarrow \alpha A'$$
$$A' \longrightarrow \beta_1 \mid \beta_2$$