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COURSE NAME 19CSB301&Automata Theory Compiler Design

III YEAR/ V SEMESTER

UNIT – III SYNTAX ANALYSIS AND SEMANTIC ANALYSIS

Topic: Syntax Analysis & The role of the Parser

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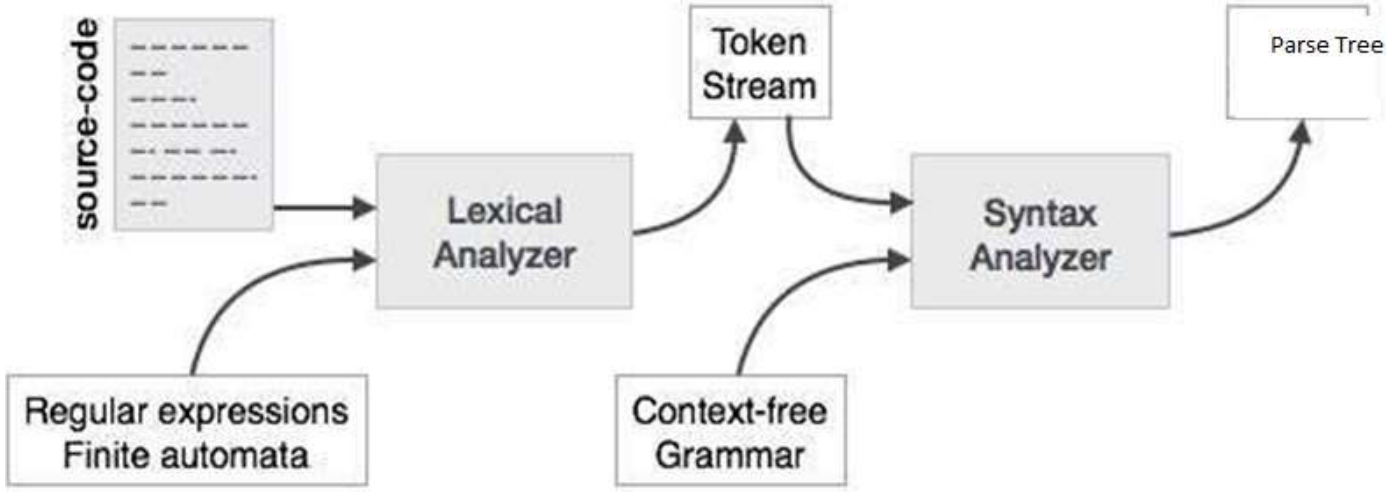
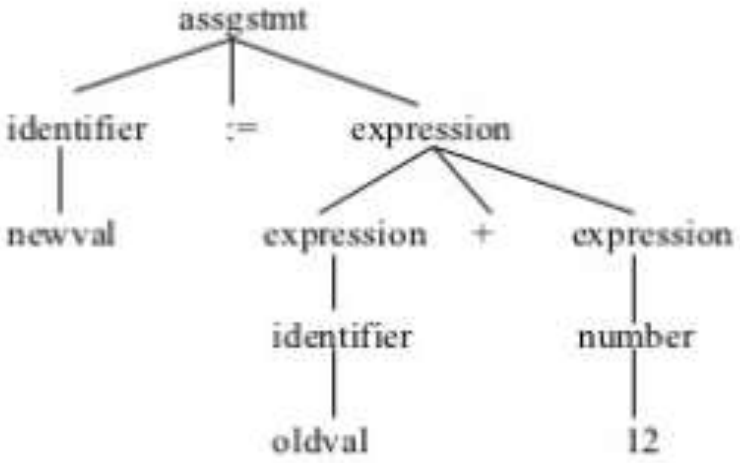
Syntax Analysis

Syntax Analysis is a second phase of the compiler design process in which the given input string is checked for the confirmation of rules and structure of the formal grammar. It **analyses** the syntactical structure and checks if the given input is in the correct **syntax** of the programming language or not.



Syntax Analysis

- A **Syntax Analyzer** creates the syntactic structure (generally a parse tree) of the given program.
- A syntax analyzer is also called as a **parser**.
- A **parse tree** describes a syntactic structure.



- In a parse tree, all terminals are at leaves.
- All inner nodes are non-terminals in a context free grammar.

Syntax Analysis

THE ROLE OF PARSER

The parser or syntactic analyzer obtains a string of tokens from the lexical analyzer and verifies that the string can be generated by the grammar for the source language. It reports any syntax errors in the program. It also recovers from commonly occurring errors so that it can continue processing its input.

1. It verifies the structure generated by the tokens based on the grammar.
2. It constructs the parse tree.
3. It reports the errors.
4. It performs error recovery.

Issues :

Parser cannot detect errors such as:
1. Variable re-declaration
2. Variable initialization before use
3. Data type mismatch for an operation.

The above issues are handled by Semantic Analysis phase.

Syntax Analysis

Syntax error handling :

Programs can contain errors at many different levels. For example :

1. Lexical, such as misspelling an identifier, keyword or operator.
2. Syntactic, such as an arithmetic expression with unbalanced parentheses.
3. Semantic, such as an operator applied to an incompatible operand.
4. Logical, such as an infinitely recursive call

Functions of error handler :

1. It should report the presence of errors clearly and accurately.
2. It should recover from each error quickly enough to be able to detect subsequent errors.
3. It should not significantly slow down the processing of correct programs.

Error recovery strategies :

The different strategies that a parse uses to recover from a syntactic error are:

1. Panic mode
2. Phrase level
3. Error productions
4. Global correction

Panic mode recovery:

On discovering an error, the parser discards input symbols one at a time until a synchronizing token is found. The synchronizing tokens are usually delimiters, such as semicolon or end. It has the advantage of simplicity and does not go into an infinite loop. When multiple errors in the same statement are rare, this method is quite useful.

Phrase level recovery:

On discovering an error, the parser performs local correction on the remaining input that allows it to continue. Example: Insert a missing semicolon or delete an extraneous semicolon etc.

Syntax Analysis

Error productions:

The parser is constructed using augmented grammar with error productions. If an error production is used by the parser, appropriate error diagnostics can be generated to indicate the erroneous constructs recognized by the input.

Global correction:

Given an incorrect input string x and grammar G, certain algorithms can be used to find a parse tree for a string y, such that the number of insertions, deletions and changes of tokens is as small as possible. However, these methods are in general too costly in terms of time and space.

Syntax Analysis

- The syntax of a language is specified by a **context free grammar** (CFG).
- The rules in a CFG are mostly recursive.
- A syntax analyzer checks whether a given program satisfies the rules implied by a CFG or not.
  - If it satisfies, the syntax analyzer creates a parse tree for the given program.

- Ex: We use BNF (Backus Naur Form) to specify a CFG

```
assgstmt    -> identifier := expression
expression  -> identifier
expression  -> number
expression  -> expression + expression
```


Thank
you