Compiler Design

Introduction To Syntax Analysis

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Introduction To Syntax Analysis

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- The parser (**syntax analyzer**) receives the source code in the form of **tokens** from the lexical analyzer and performs syntax analysis, which create a tree-like intermediate representation that depicts the grammatical structure of the token stream.
  - Syntax analysis is also called parsing.
  - A typical representation is a abstract syntax tree in which
    - each interior node represents an operation
    - the children of the node represent the arguments of the operation

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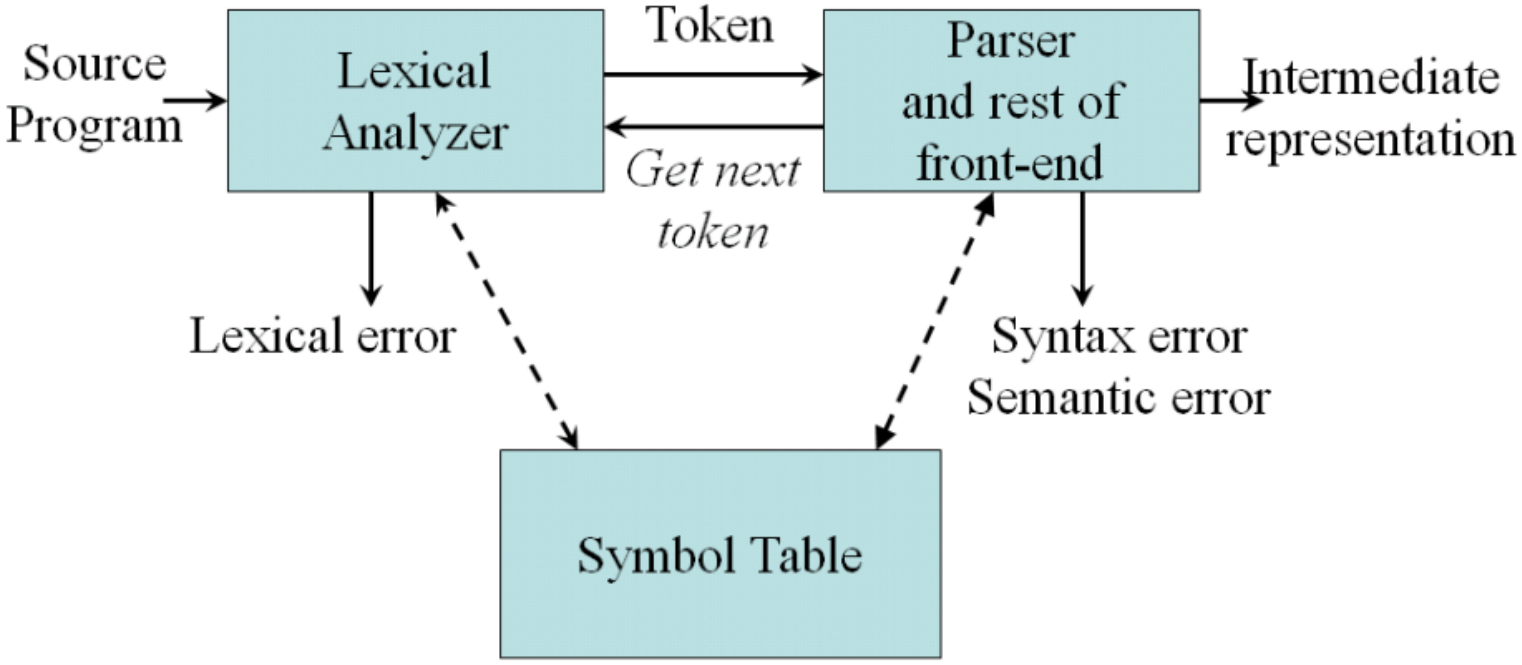
Syntax Analyzer - Overview



Role of Parser

- Checks the stream of words and their parts of speech (produced by the scanner) for grammatical correctness
- Determines if the input is syntactically well formed
- Guides checking at deeper levels than syntax (static semantics checking)
- Builds an IR representation of the code

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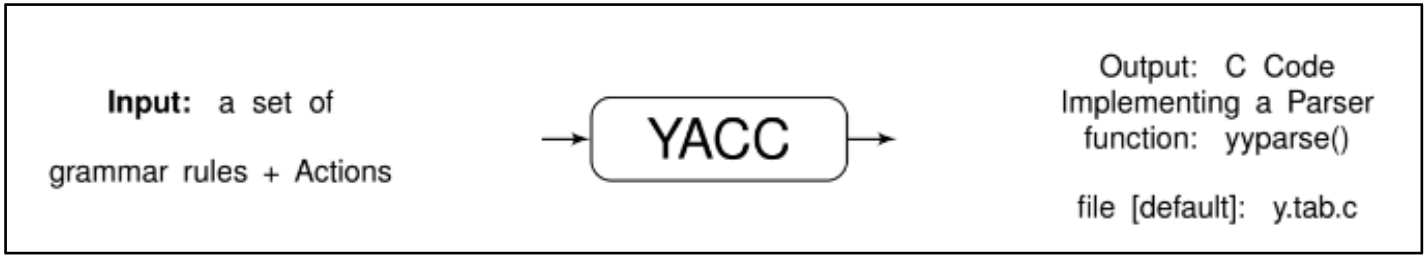
YACC Parser — Overview

Parser generator

- Takes a specification for context-free grammar.
- Produces code for a parser.



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- Communicated to scanner in file `y.tab.h`

  use `yacc -d` to produce `y.tab.h`

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- Token encodings:
  - **"end of file"** represented by 0;
  - a character literal: its **ASCII** value;
  - other tokens: assigned numbers $\geq$ **257**

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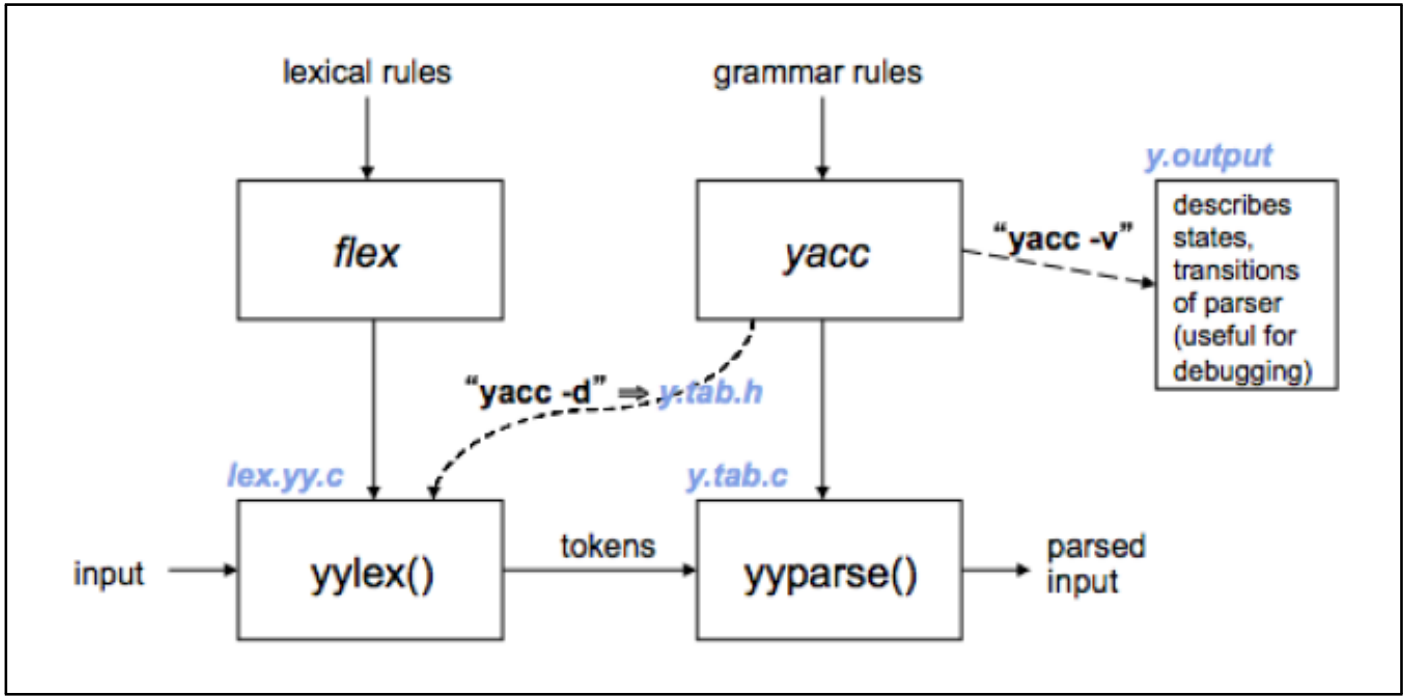
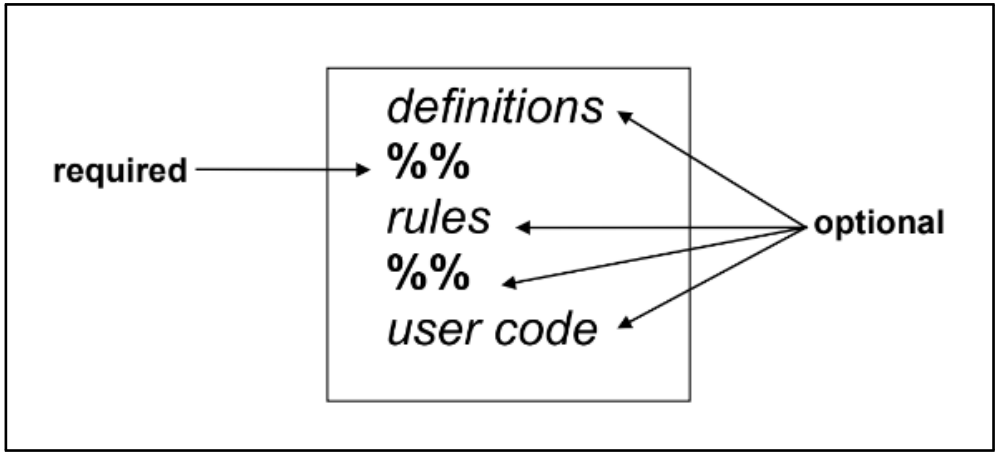


flex input format

A YACC input file consists of three parts:



- Shortest possible legal YACC input:

```
%%
```

Definition Section

There are three things that can go in the definitions section:

- C code: Code between % and % is copied to the C file.
- Definitions:
- **Associativity Rules:** These handle associativity and priority of operators.

Information about Tokens

- **token names:**
  - declared using **'%token'**.
  - single-character tokens don't have to be declared.
  - any name not declared as a token is assumed to be a nonterminal.
- start symbol of grammar, using **%start [optional]**
- operator info:
  - precedence, associativity.

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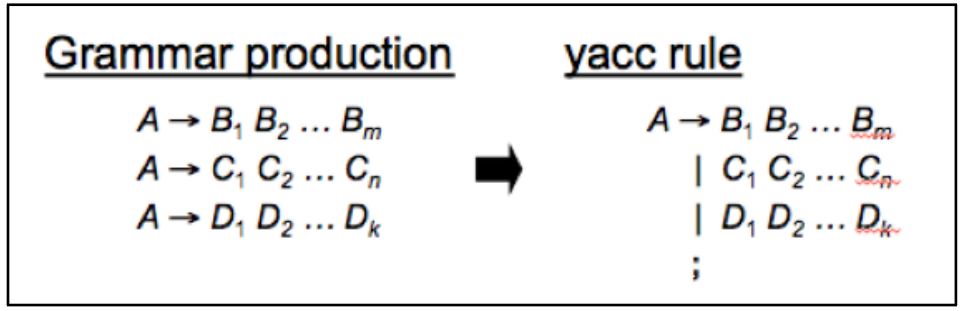
Rules section

- The rules section contains the grammar of the language you want to parse. This looks like



- Rule RHS can have arbitrary C code embedded, within . . . .

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Conflicts

Conflicts

- Conflicts arise when there is more than one way to proceed with parsing.
- Two types:
  - shift-reduce [default action: shift]
  - reduce-reduce [default: reduce with the first rule listed]
- Removing conflicts:
  - specify operator precedence, associativity;
  - restructure the grammar

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User code section

- The minimal main program is:

```
int main ()
 {
      yyparse();
      return 0;
 }
```

Assignment

Write YACC specification to design a parser for a subset of the C language. Consider the following programming language constructs:

- Main function
- Statements
  - Statements like local/global declarations.
  - Assignment Statements.
  - Conditional Statements.
  - Iterative Statements
  - Function Call
- User defined functions

Consider the assumptions for the language previously considered in last lab sessions. Variables of data types allowed in the subset can be defined at the very beginning of any function / block. A variable must be defined before it is used.

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References

- Alfred V. Aho, Ravi Sethi, Jeffrey D Ullman, “Compilers Principles Techniques and Tools”, Pearson Education.

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