

Programming Languages and Compilers: Quiz #1

Due on March 6, 2024 at 3:10pm

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Problem 1

Draw a figure to show the structure of a syntax-directed compiler, and briefly describe each phase.

Solution

First, let's draw a figure to show the structure of a syntax-directed compiler.

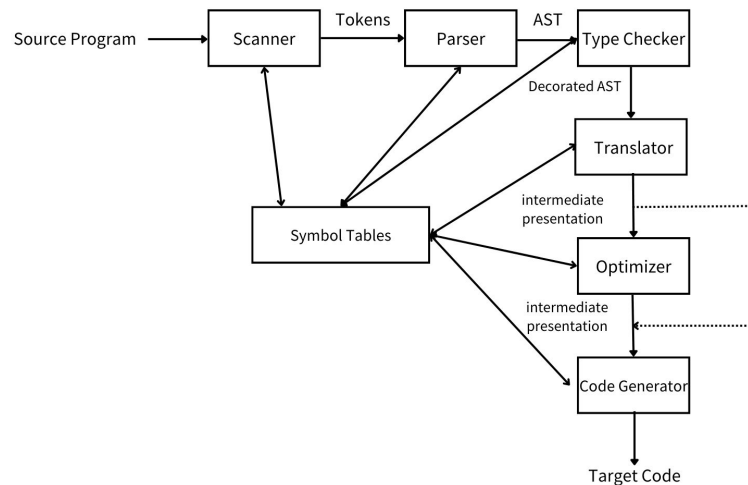


Figure 1: syntax-directed compiler

Scanner First, the scanner reads the input program and breaks it into a sequence of small pieces called tokens. Each token is a single logical unit of the program, such as a keyword, an identifier, a constant, or a symbol. The scanner also removes comments and whitespace from the source program.

Parser The parser uses the tokens produced by the scanner to create a parse tree, which is a hierarchical representation of the program's syntactic structure. The parse tree is used to check the syntax of the program and to generate intermediate code.

Type Checker The type checker verifies that the program's type system is consistent and that the program is free of type errors. It also assigns types to expressions and checks that the types of operands are compatible with the operators being applied to them.

Symbol Tables The symbol tables store information about the program's identifiers, such as their names, types, and scopes. The symbol tables are used by the compiler to resolve references to identifiers and to perform type checking.

Translator The translator generates intermediate code, which is a low-level representation of the program that is easier to analyze and optimize than the original source code. The intermediate code is used as input to the code generator.

Optimizer The optimizer analyzes the intermediate code and applies various transformations to improve its performance. These transformations include constant folding, common subexpression elimination, and loop optimization.

Code Generator Finally, the code generator translates the intermediate code into machine code for the target architecture. The machine code is the executable form of the program that can be run on the target machine.