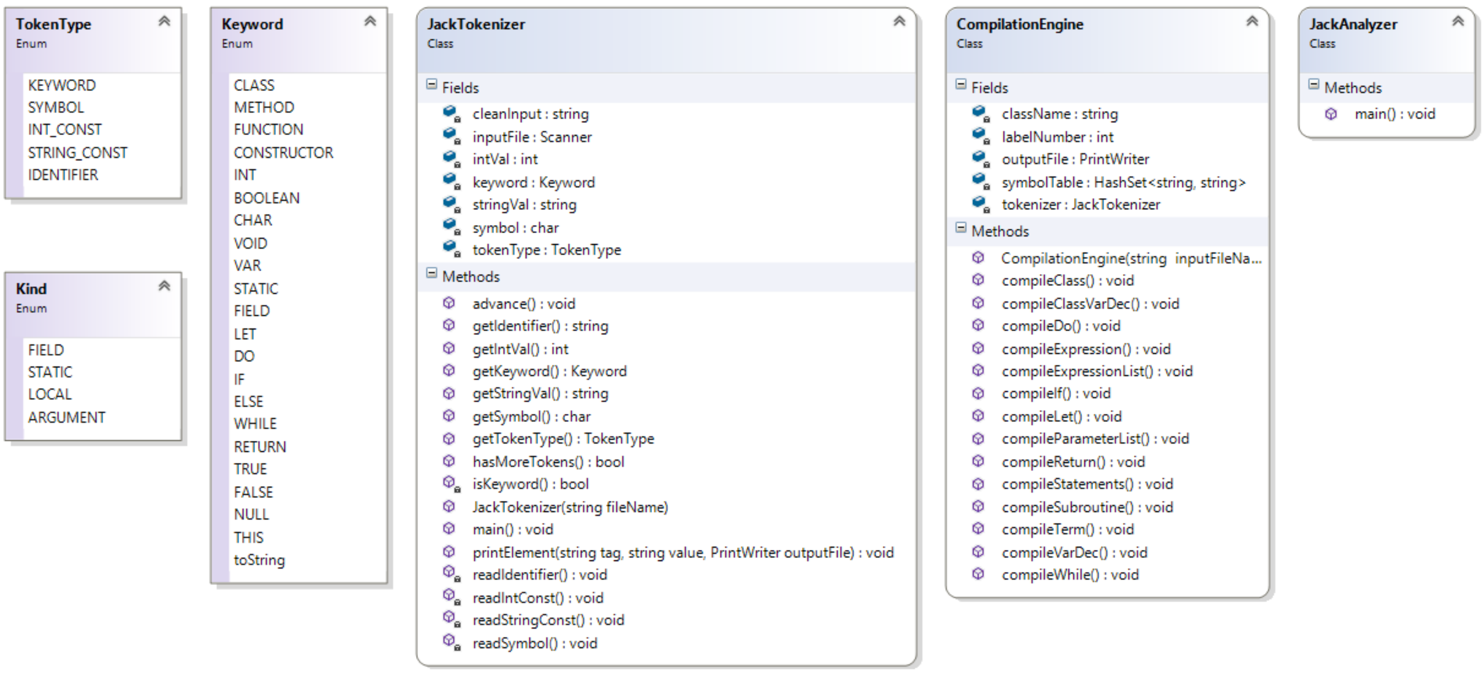
The Jack Compiler 1:
Syntax Analysis



TokenType
Enum

- KEYWORD
- SYMBOL
- INT_CONST
- STRING_CONST
- IDENTIFIER

Kind
Enum

- FIELD
- STATIC
- LOCAL
- ARGUMENT

Keyword
Enum

- CLASS
- METHOD
- FUNCTION
- CONSTRUCTOR
- INT
- BOOLEAN
- CHAR
- VOID
- VAR
- STATIC
- FIELD
- LET
- DO
- IF
- ELSE
- WHILE
- RETURN
- TRUE
- FALSE
- NULL
- THIS
- toString

JackTokenizer
Class

Fields
- cleanInput : string
- inputFile : Scanner
- intVal : int
- keyword : Keyword
- stringVal : string
- symbol : char
- tokenType : TokenType

Methods
- advance() : void
- getIdentifier() : string
- getIntVal() : int
- getKeyword() : Keyword
- getStringVal() : string
- getSymbol() : char
- getTokenType() : TokenType
- hasMoreTokens() : bool
- isKeyword() : bool
- JackTokenizer(string fileName)
- main() : void
- printElement(string tag, string value, PrintWriter outputFile) : void
- readIdentifier() : void
- readIntConst() : void
- readStringConst() : void
- readSymbol() : void

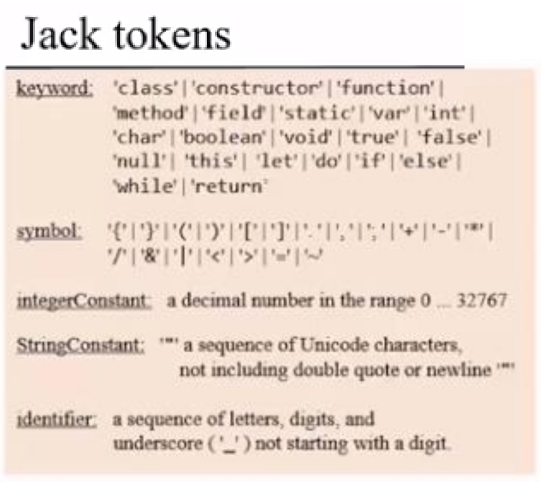
CompilationEngine
Class

Fields
- className : string
- labelNumber : int
- outputFile : PrintWriter
- symbolTable : HashSet<string, string>
- tokenizer : JackTokenizer

Methods
- CompilationEngine(string inputFileNa...
- compileClass() : void
- compileClassVarDec() : void
- compileDo() : void
- compileExpression() : void
- compileExpressionList() : void
- compileIf() : void
- compileLet() : void
- compileParameterList() : void
- compileReturn() : void
- compileStatements() : void
- compileSubroutine() : void
- compileTerm() : void
- compileVarDec() : void
- compileWhile() : void

JackAnalyzer
Class

Methods
- main() : void



Jack tokens

<u>keyword</u>: 'class' | 'constructor' | 'function' | 'method' | 'field' | 'static' | 'var' | 'int' | 'char' | 'boolean' | 'void' | 'true' | 'false' | 'null' | 'this' | 'let' | 'do' | 'if' | 'else' | 'while' | 'return'

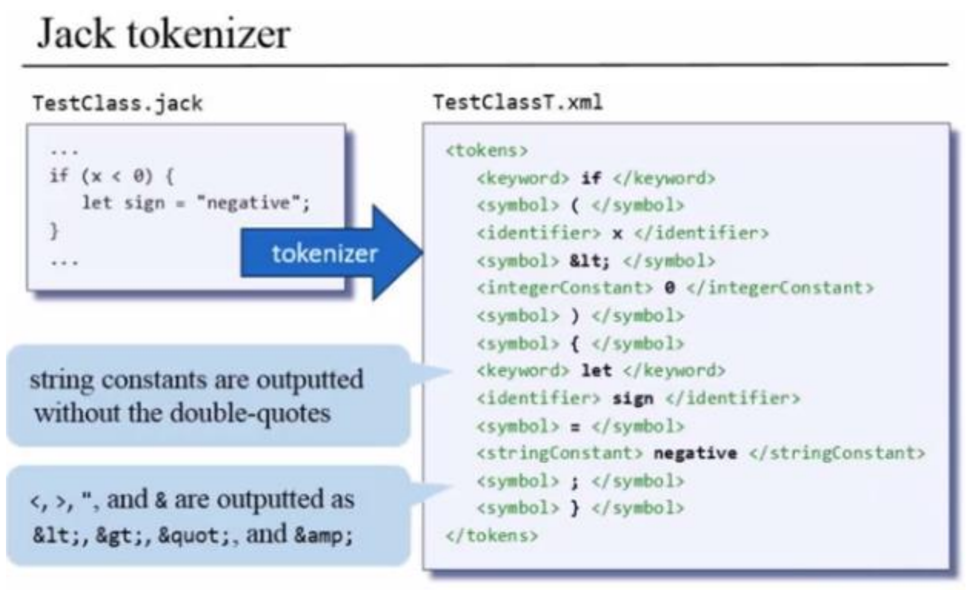
symbol: '{' | '}' | '(' | ')' | '[' | ']' | '.' | ',' | ';' | '+' | '-' | '*' | '/' | '&' | '|' | '<' | '>' | '=' | '~'

integerConstant: a decimal number in the range 0 ... 32767

StringConstant: '"' a sequence of Unicode characters, not including double quote or newline '"'

identifier: a sequence of letters, digits, and underscore ('_') not starting with a digit.

Jack tokenizer



TestClass.jack

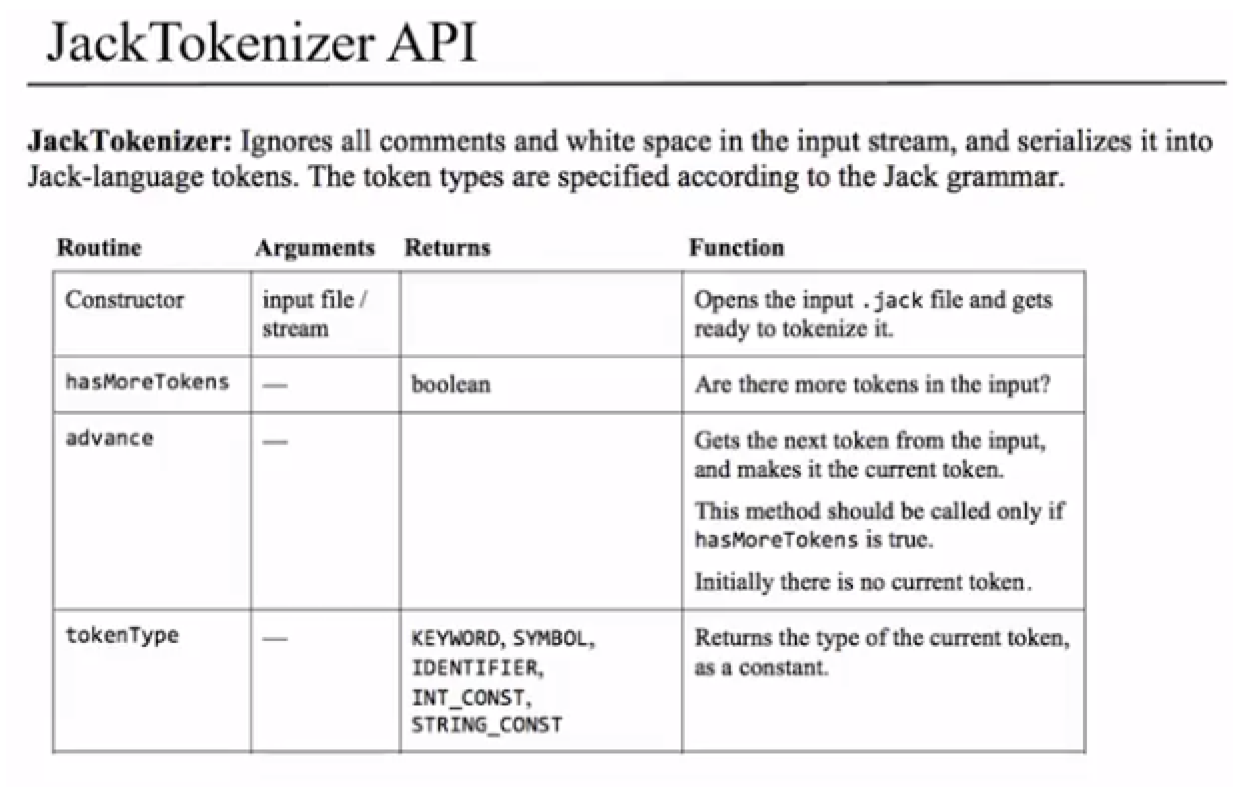
```
...
if (x < 0) {
    let sign = "negative";
}
...
```

TestClassT.xml

```
<tokens>
  <keyword> if </keyword>
  <symbol> ( </symbol>
  <identifier> x </identifier>
  <symbol> &lt; </symbol>
  <integerConstant> 0 </integerConstant>
  <symbol> ) </symbol>
  <symbol> { </symbol>
  <keyword> let </keyword>
  <identifier> sign </identifier>
  <symbol> = </symbol>
  <stringConstant> negative </stringConstant>
  <symbol> ; </symbol>
  <symbol> } </symbol>
</tokens>
```

string constants are outputted without the double-quotes

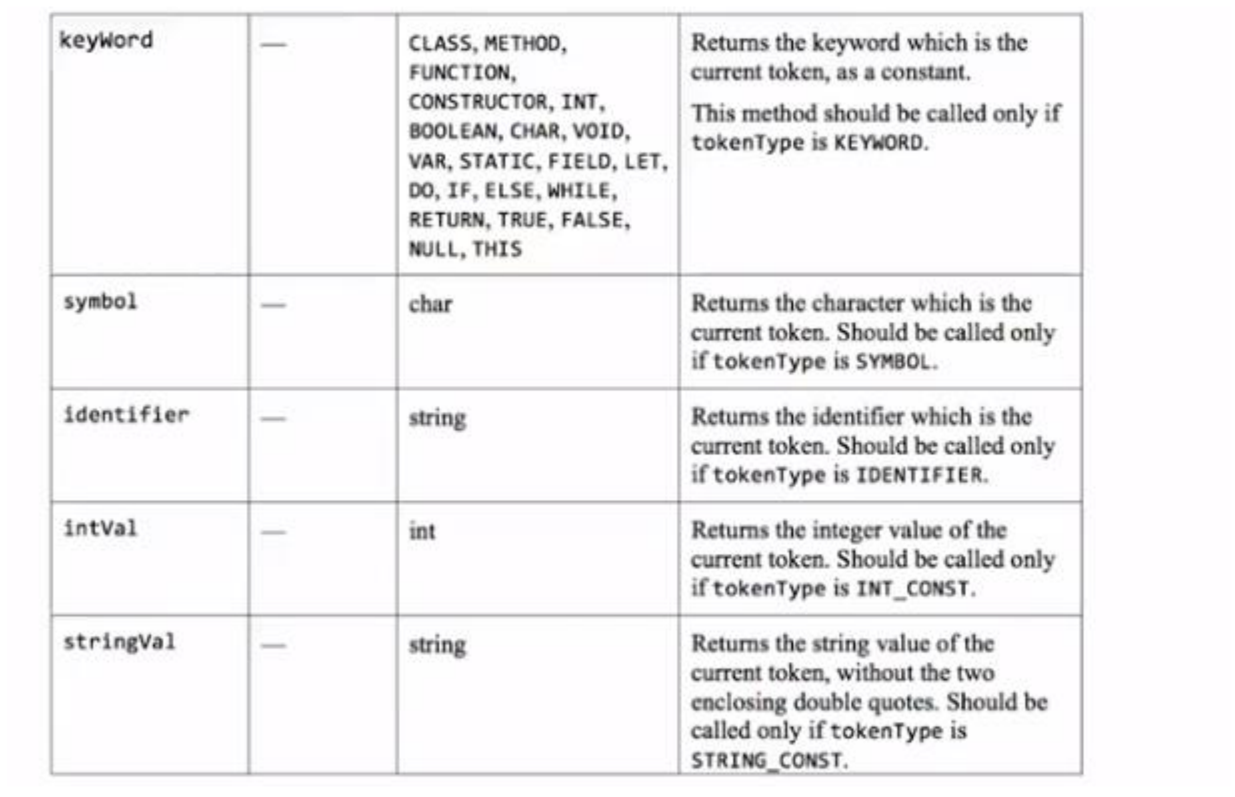
<, >, ", and & are outputted as &lt;, &gt;, &quot;, and &amp;



JackTokenizer API

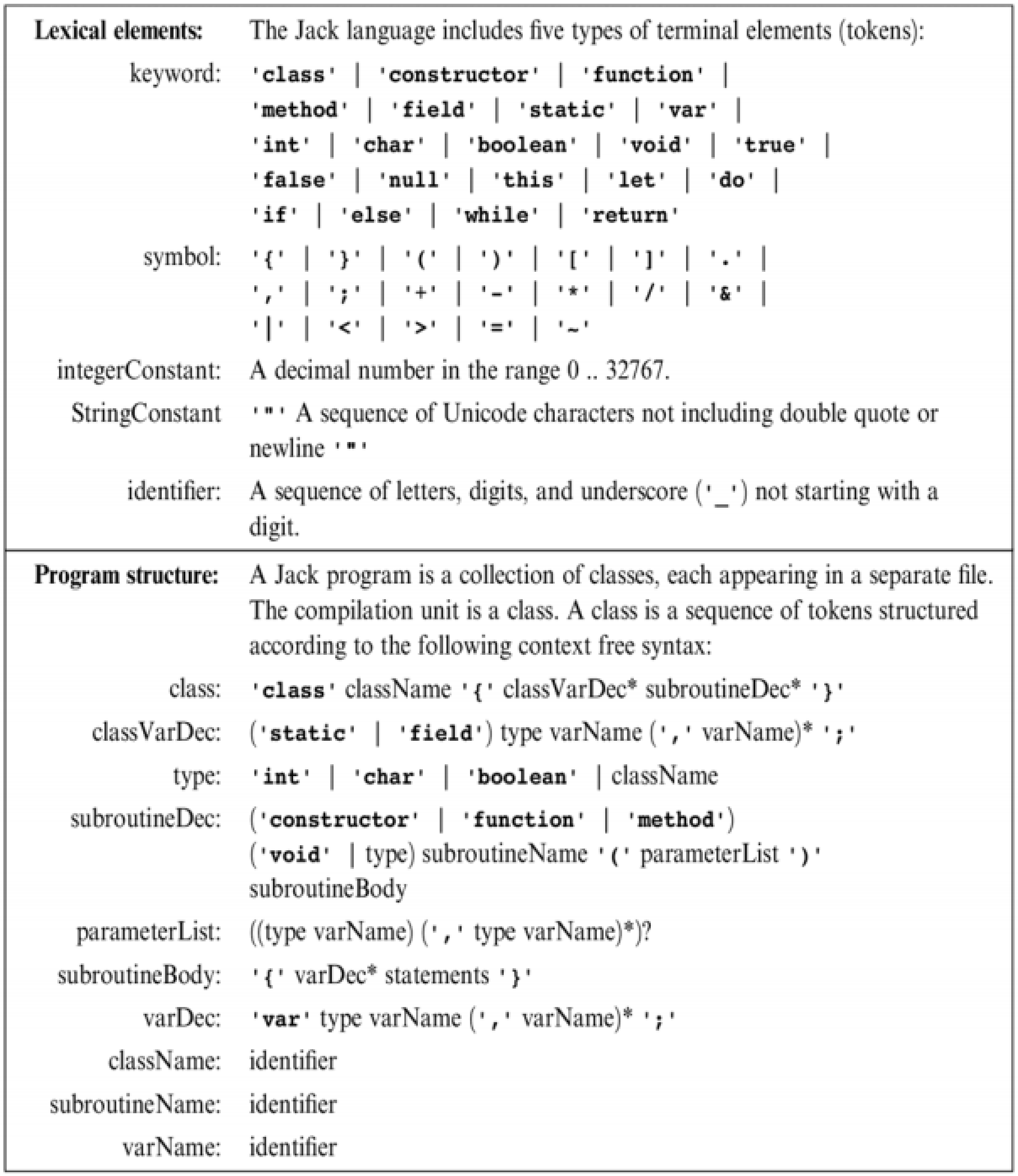
JackTokenizer: Ignores all comments and white space in the input stream, and serializes it into Jack-language tokens. The token types are specified according to the Jack grammar.

Routine	Arguments	Returns	Function
Constructor	input file / stream		Opens the input `.jack` file and gets ready to tokenize it.
`hasMoreTokens`	—	boolean	Are there more tokens in the input?
`advance`	—		Gets the next token from the input, and makes it the current token. This method should be called only if `hasMoreTokens` is true. Initially there is no current token.
`tokenType`	—	`KEYWORD`, `SYMBOL`, `IDENTIFIER`, `INT_CONST`, `STRING_CONST`	Returns the type of the current token, as a constant.



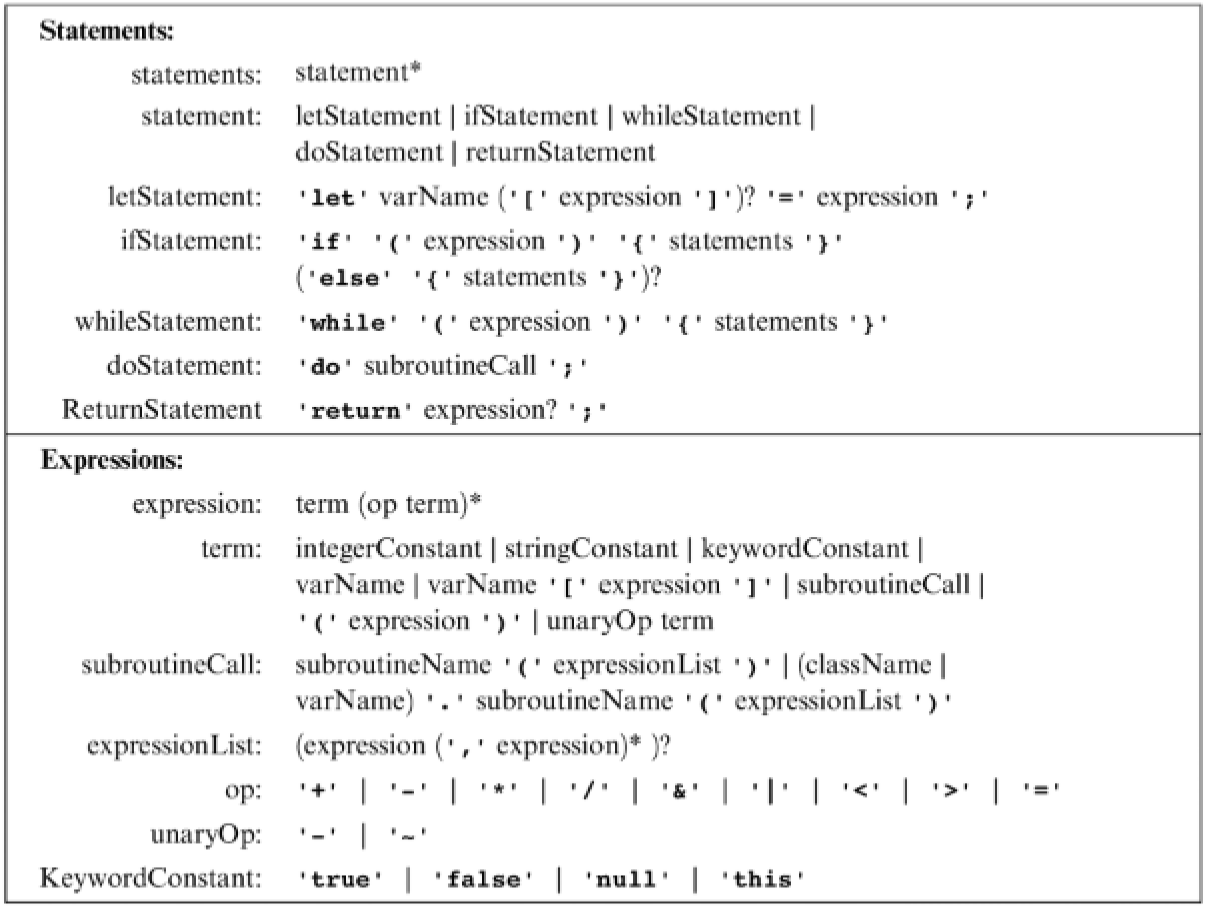
`keyWord`	—	`CLASS`, `METHOD`, `FUNCTION`, `CONSTRUCTOR`, `INT`, `BOOLEAN`, `CHAR`, `VOID`, `VAR`, `STATIC`, `FIELD`, `LET`, `DO`, `IF`, `ELSE`, `WHILE`, `RETURN`, `TRUE`, `FALSE`, `NULL`, `THIS`	Returns the keyword which is the current token, as a constant. This method should be called only if `tokenType` is `KEYWORD`.
`symbol`	—	char	Returns the character which is the current token. Should be called only if `tokenType` is `SYMBOL`.
`identifier`	—	string	Returns the identifier which is the current token. Should be called only if `tokenType` is `IDENTIFIER`.
`intVal`	—	int	Returns the integer value of the current token. Should be called only if `tokenType` is `INT_CONST`.
`stringVal`	—	string	Returns the string value of the current token, without the two enclosing double quotes. Should be called only if `tokenType` is `STRING_CONST`.

The Jack Language Grammar



Lexical elements:	The Jack language includes five types of terminal elements (tokens):
keyword:	**'class'** | **'constructor'** | **'function'** | **'method'** | **'field'** | **'static'** | **'var'** | **'int'** | **'char'** | **'boolean'** | **'void'** | **'true'** | **'false'** | **'null'** | **'this'** | **'let'** | **'do'** | **'if'** | **'else'** | **'while'** | **'return'**
symbol:	'{' | '}' | '(' | ')' | '[' | ']' | '.' | ',' | ';' | '+' | '-' | '*' | '/' | '&' | '|' | '<' | '>' | '=' | '~'
integerConstant:	A decimal number in the range 0 .. 32767.
StringConstant	'"' A sequence of Unicode characters not including double quote or newline '"'
identifier:	A sequence of letters, digits, and underscore ('_') not starting with a digit.
Program structure:	A Jack program is a collection of classes, each appearing in a separate file. The compilation unit is a class. A class is a sequence of tokens structured according to the following context free syntax:
class:	**'class'** className '{' classVarDec* subroutineDec* '}'
classVarDec:	(**'static'** | **'field'**) type varName (',' varName)* ';'
type:	**'int'** | **'char'** | **'boolean'** | className
subroutineDec:	(**'constructor'** | **'function'** | **'method'**) (**'void'** | type) subroutineName '(' parameterList ')' subroutineBody
parameterList:	((type varName) (',' type varName)*)?
subroutineBody:	'{' varDec* statements '}'
varDec:	**'var'** type varName (',' varName)* ';'
className:	identifier
subroutineName:	identifier
varName:	identifier

The Jack Language Grammar (continued)



Statements:	
statements:	statement*
statement:	letStatement | ifStatement | whileStatement | doStatement | returnStatement
letStatement:	'**let**' varName ('[' expression ']')? '=' expression ';'
ifStatement:	'**if**' '(' expression ')' '{' statements '}' ('**else**' '{' statements '}')?
whileStatement:	'**while**' '(' expression ')' '{' statements '}'
doStatement:	'**do**' subroutineCall ';'
ReturnStatement	'**return**' expression? ';'
Expressions:	
expression:	term (op term)*
term:	integerConstant | stringConstant | keywordConstant | varName | varName '[' expression ']' | subroutineCall | '(' expression ')' | unaryOp term
subroutineCall:	subroutineName '(' expressionList ')' | (className | varName) '.' subroutineName '(' expressionList ')'
expressionList:	(expression (',' expression)*)?
op:	'+' | '-' | '*' | '/' | '&' | '|' | '<' | '>' | '='
unaryOp:	'-' | '~'
KeywordConstant:	'**true**' | '**false**' | '**null**' | '**this**'