# Syntax Diagrams

2004/03/11 13:54:42

## 1 Introduction

A convenient way to visualise a grammar is to imagine that it is a railway system, where any valid path taken by a train creates a sentence belonging to the language of the grammar. These pictorial representations of grammars are called *railroad diagrams* or more commonly *syntax diagrams*.

This note explores syntax diagrams for a subset of the Java language.

## 2 Types

To start with something simple, consider the syntax for specifying types in Java. In the following we can see two examples: **`int`** and **`String[]`**.

```
int iOffset;
static public void main(String[] args)
```

We can generalize what we see and and present it using the syntax diagrams in Figure 1.

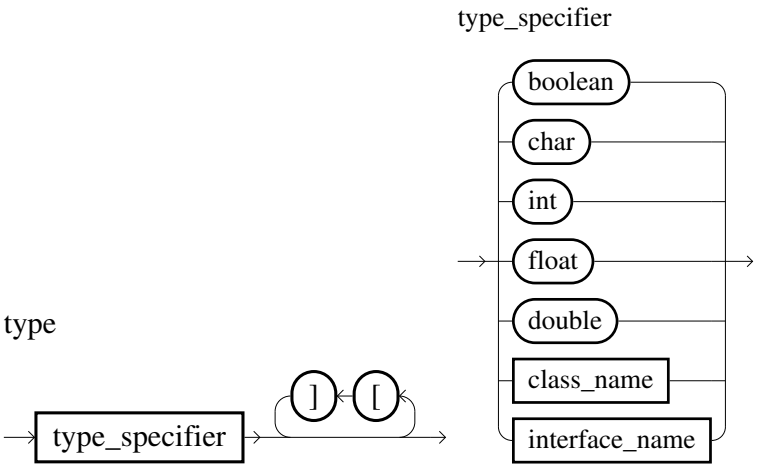



Figure 1: Two syntax diagrams: the left is the `type` syntax diagram and the right is the `type_specifier` syntax diagram.

A *terminal* is something which is written literally, such as `int`, while a *non-terminal* is expanded into other terminals and non-terminals. In this notation, non-terminals appear in boxes and terminals are circled.

In this figure we see that types are specified with a `type_specifier` followed by a number of optional `[]`. `type_specifier` can be any native Java type or the name of a class or interface. `[]` specifies that the type is an array. For the purposes of this note `class_name` and `identifier_name` mean the same as `identifier`.

**String[]** is also a valid type since it is generated by choosing the path through `class_name` and by taking the optional `type` path that adds `[]`. The path through `class_name` is chosen because String is a class and the path through the `[` and then `]` is taken because in our example we have declared an array of String.

# 3 Identifiers

Java identifiers are the names given for classes, interfaces, packages, methods, and variables. Properly formed identifiers begin with a letter, underscore, or dollar sign, are case sensitive and have no maximum length. Figure 2 shows the syntax diagram corresponding to a Java identifier.

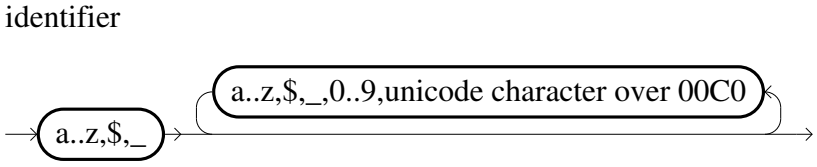



Figure 2: Identifier syntax diagram.

# 4 Modifiers

Now let us look at another important part of Java: modifiers. Figure 3 shows the syntax diagram corresponding to modifiers.

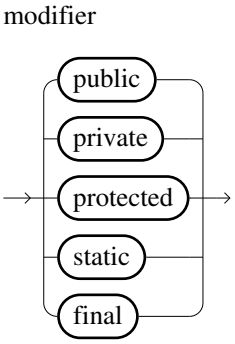



Figure 3: Modifier syntax diagram.

# 5 Variable Declaration

Now we can combine what we have learned so far (types, identifiers and modifiers) into something more interesting: variable declarations. The following example shows two variable declarations.

```
int i, j, k;
private static HashMap _data[];
```

Figure 4 – 6 show the syntax diagram for variable declaration in Java. Try following the syntax diagrams using the example.

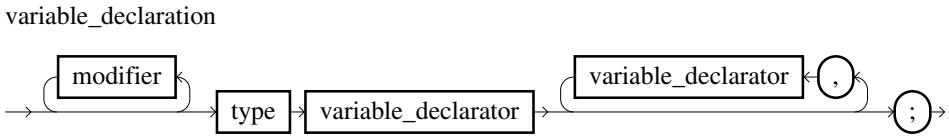



Figure 4: Syntax diagram for variable declaration in Java.

The `variable_declarator` non-terminal contains an identifier and an optional initialiser. Additionally, the variable declarator can specify that the variable is an array. Note that this is different than a `type` specified array as shown in Section 2. Figure 5 gives a closer look at this.

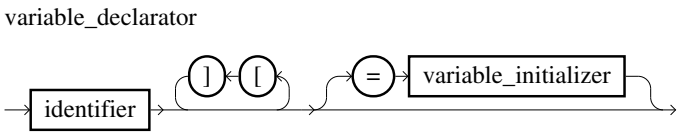



Figure 5: Variable declarator syntax.

Finally, the `variable_initializer` (Figure 6) is responsible for giving the variable its initial values.

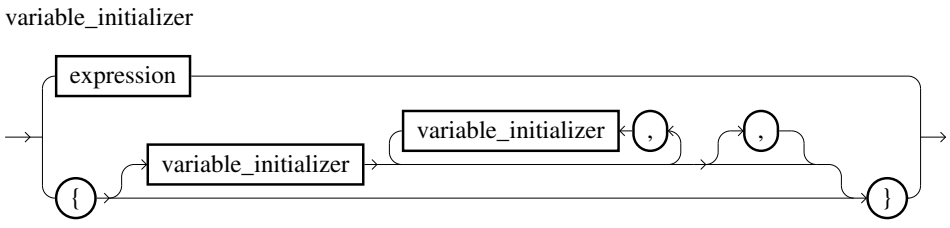
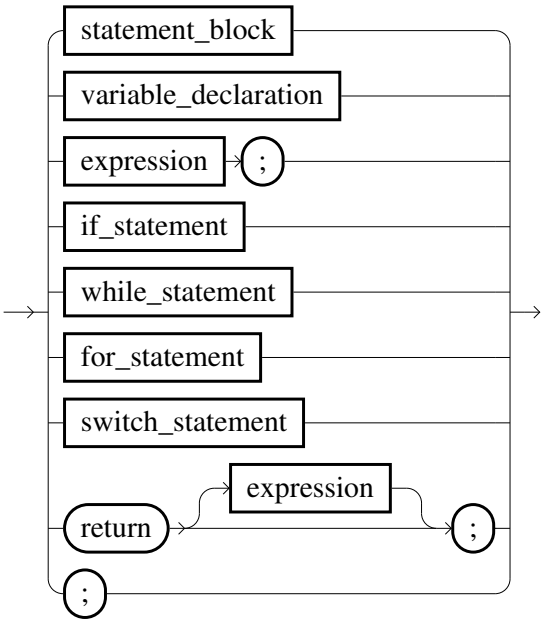



Figure 6: Syntax diagram for variable initializer.

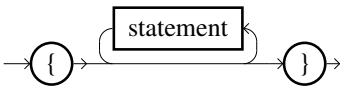
# 6 Reference

Figure 7 – 9 show syntax diagrams for commonly used components of Java. Note that many of these examples are simplified for brevity.

statement




statement_block




expression

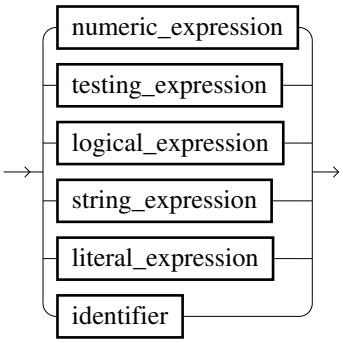
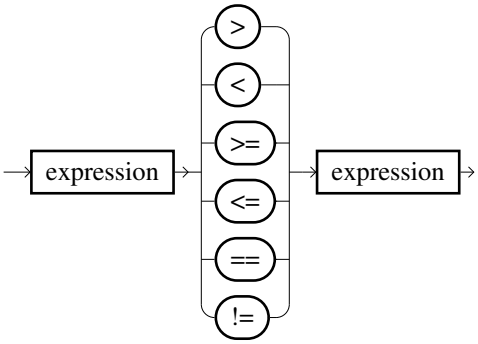
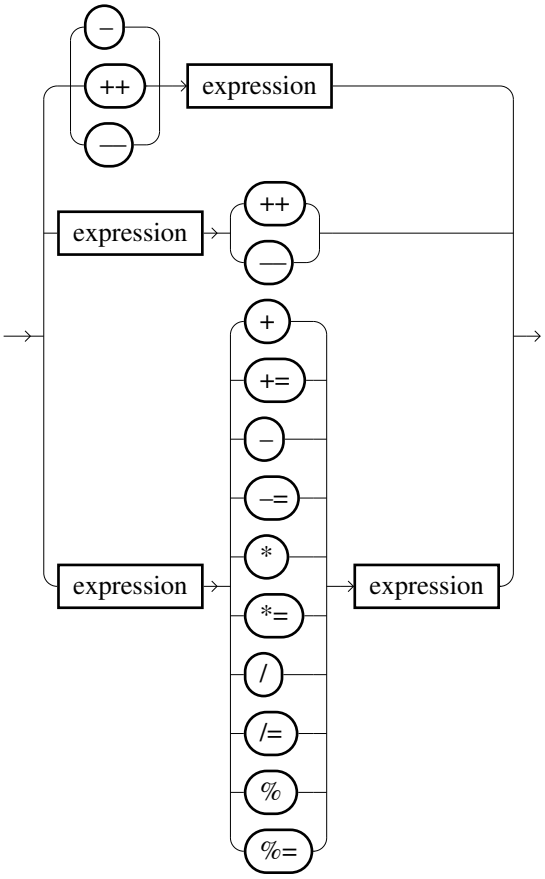



Figure 7: Statements and expressions.

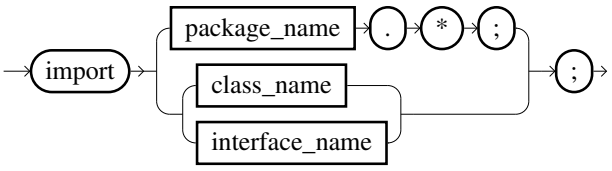
testing_expression




numeric_expression




import_statement




if_statement

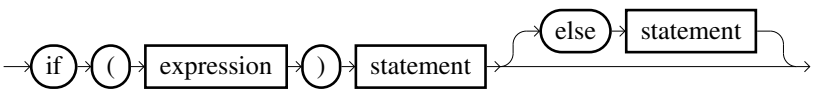
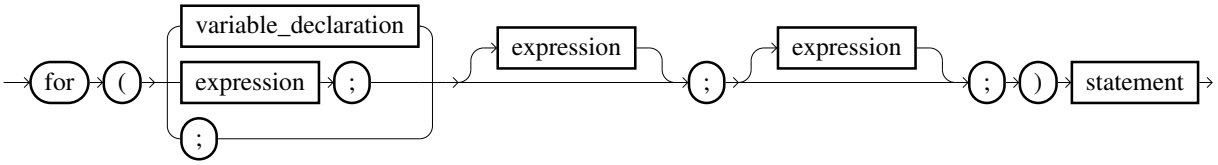
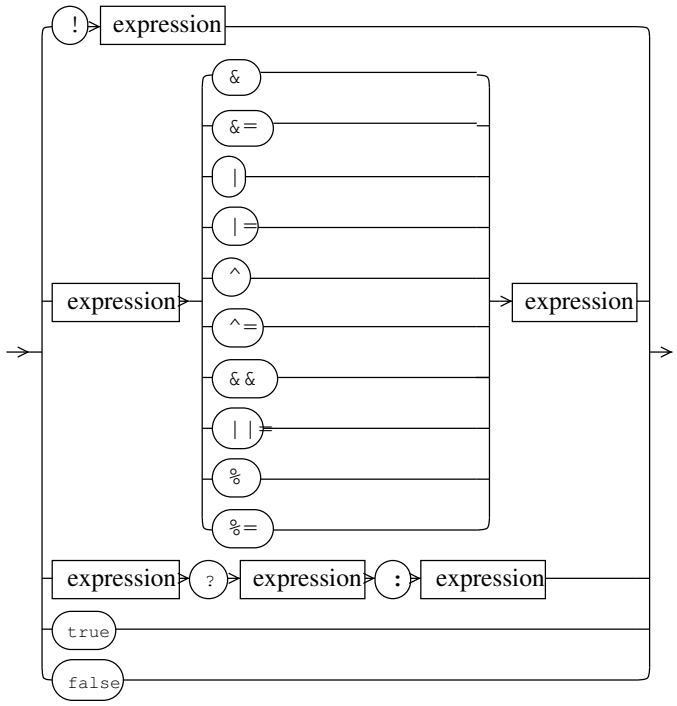



Figure 8: More statements and expressions.

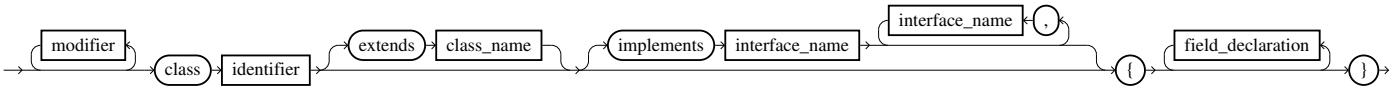
for_statement



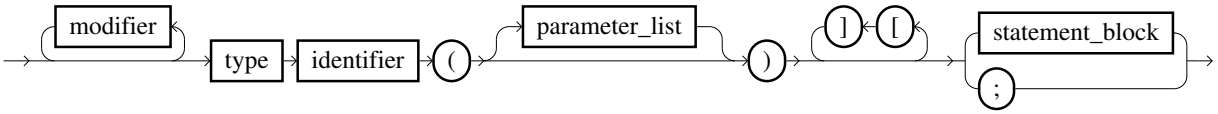

logical_expression



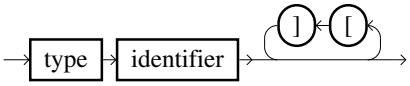

class_declaration




method_declaration




parameter




parameter_list

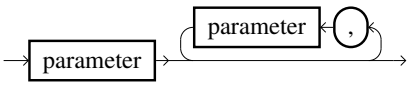



Figure 9: A couple more statements and expressions. Class declarations, and methods.