CS3410: Software Engineering Lab
LR(1) parser for JavaCC

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1 Introduction

In this project, we built a LR(1) parser generator for JavaCC. Currently, JavaCC can generate parser generator for LL(k) parser. The main drawback with LL(k) grammars is that it does not include left recursive grammars. Though, there are algorithms to convert left recursive grammars to non-left recursive case, they lead to an explosion in the number of productions and hence inefficient. On the other hand, LR(1) parsers can parse left recursive grammars.

2 Cohesion and Coupling

The main parser for the JavaCC parser was located in the src/org/javacc/parser/. Though we had to make changes to one file and add two files to the folder, we had to comprehensively study all the 66 files present in the parser folder in order to fully understand the data abstraction and the control flow that was happening. As and when we went through the code, we made the following observations regarding the cohesion and coupling between models.

Cohesion Analysis

The functions within the module exhibited fairly high cohesion like functional or sequential cohesion. As far as we observed, we didn't find any instance of logical or coincidental cohesion in a function.

Even in the functions that we added to the src/org/javacc/parser/ParseEngine.java we ensured that they had functional or sequential cohesion. There were cases where we had to give different outputs depending on whether the token was a non-terminal or a terminal (eg. computeGoTo(), buildClosure()). But this would have lead to logical cohesion within the function. Hence, in order to avoid this we split the function and wrote separate functions for computeGoToRegEx() and computeGoToNonTerminal() which individually exhibit functional cohesion.

Coupling Analysis

In the parser folder, JavaCCGlobals.java contains global data structures which can be accessed by the rest of the parser module. Basically, it contains the list of constants, terminals which were observed during the lexical analysis. Hence, JavaCCGlobals.java has common coupling with other modules like ParseEngine.java and ParseGen.java.

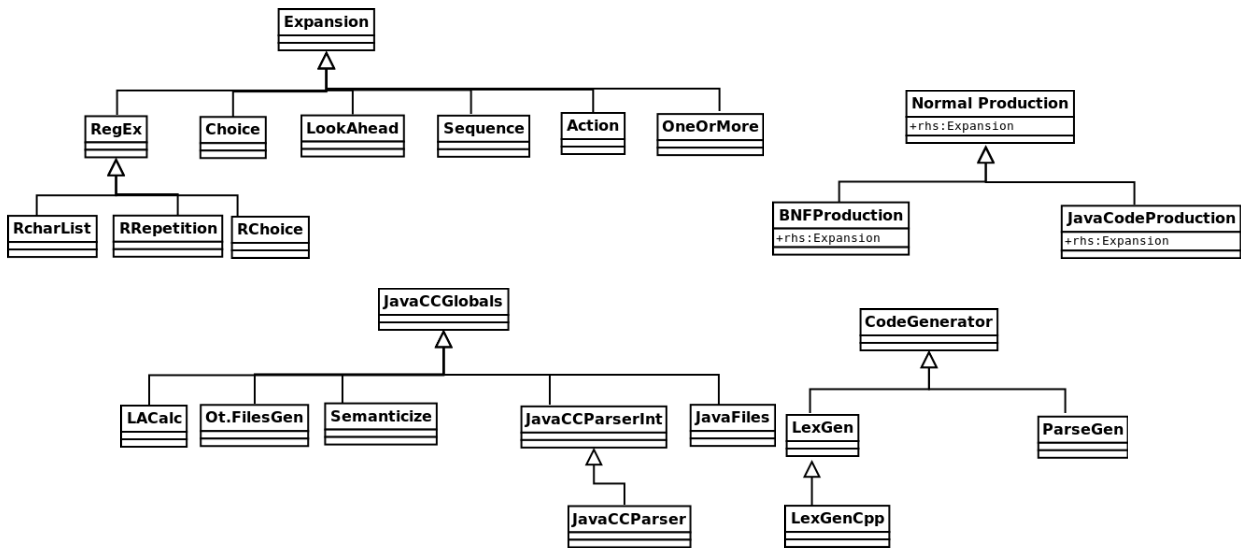
We were careful in not introducing any instance of common coupling between the modules where we made changes. All the data structures we used were local to a particular class and is not accessible else where.

Hence, we introduced loose coupling within the modules were we made changes (At worst, we introduced stamp coupling within the modules where we made changes)

To conclude, though parser files exhibit high levels of cohesion at a functional level, there are instances of common coupling which need to be avoided for better maintainability of the code.

3 Class Hierarchies

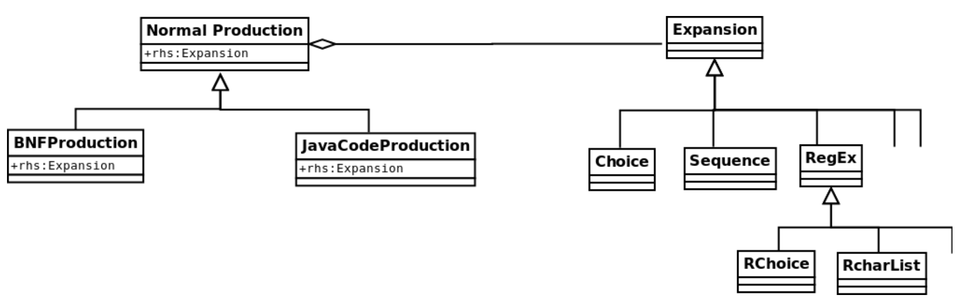
The main class hierarchies that were present in the parser file are shown below.



4 Design Patterns

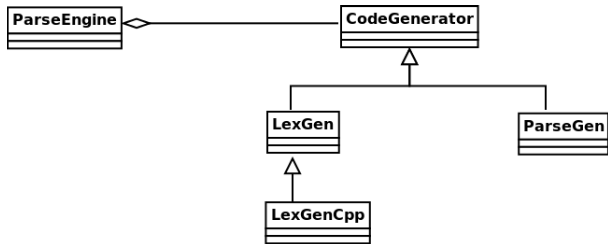
There were not many design patterns that were present in the parser folder where we concentrated entirely. We could observe one instance of the builder pattern and one instance of the factory method.

1. Builder Pattern : The builder pattern we observed is shown below.



Based on the token that the Normal production gets from the lexical analyzer, there is a complex algorithm which decides which sub-class of the rhs expansion which must be instantiated. Hence, this is an instance of the builder pattern.

2. Factory Method : The factory method we observed is shown below.



Parse engine defines an interface for creating an object, but lets the subclasses of code generator to define which concrete class to instantiate at runtime depending on the context.